

**Risky sexual behaviour among men:
HIV surveillance and risk reduction among men who have
multiple, female sexual partners in Cape Town, South Africa**

By

Loraine Townsend

Thesis presented for the degree of
Doctor of Philosophy
in the Department of Psychiatry and Mental Health
University of Cape Town

August 2010

**Risky sexual behaviour among men: HIV surveillance and risk
reduction among men who have multiple, female sexual partners in
Cape Town, South Africa**

By

Loraine Townsend

Thesis presented for the degree of

Doctor of Philosophy

in the Department of Psychiatry and Mental Health

University of Cape Town

August 2010

Supervisors: Alan J. Flisher and Catherine Mathews

This thesis is presented in fulfilment of the requirements for the degree of Doctor of Philosophy (PhD) in the Department of Psychiatry and Mental Health, Faculty of Health Sciences, University of Cape Town. The work on which the thesis is based is original research and has not, in whole or in part, been submitted for another degree at this or any other university. The contents of the thesis are entirely the work of the candidate, and in the case of multi-authored published papers, constitutes work for which the candidate in all but one instance, was the lead author. The contribution of the candidate to included multi-authored papers is further outlined in the preface to the thesis and in the introduction to each included paper where appropriate.

Loraine Townsend

August 2010

ABSTRACT

Second generation HIV surveillance surveys that collect biological and behavioural data from populations of interest is urgently needed to demonstrate accountability to domestic and international HIV funders, monitor trends in HIV and risk behaviours over time, and provide evidence of the effectiveness of HIV prevention efforts. This is particularly critical in light of dwindling HIV-related resources in the face of the global economic crisis and the attendant need to be able to lobby for scarce resources and utilize them effectively in the fight against HIV and AIDS. HIV prevalence and HIV-related risk behaviour trends have been suggested from data collected at regular intervals from pregnant women attending antenatal clinics and national household surveys among the general population in South Africa. However, there is increasing recognition of the value of and demands for regular, community-level HIV biological and behavioural surveillance surveys (BBSS) among subpopulations who engage in high-risk sexual behaviours within the general population to provide an evidence-based ability to “know your HIV epidemic” and know how to respond.

A high-risk sexual behaviour that is receiving recent international attention is multiple, concurrent sexual partnering (MCP). Concurrency is generally defined as instances where an individual has two or more sexual relationships that overlap in time. The “concurrency theory” proposes that, particularly when an individual is newly infected with HIV compared to any other stage in disease progression, the probability of transmission of HIV to other members of the individual’s sexual network increases between eight- and ten-fold. At the population level, mathematical modelling has demonstrated that when any of the members of the sexual network are also engaging in MCP, they in turn place members of their other network at increased risk. The outcome is an acceleration in the speed of HIV transmission facilitating the spread of HIV across interlinked sexual networks.

Despite the apparently normative nature of MCP particularly among men in southern Africa, interventions in a number of countries in this region that have sought to reduce sexual partner numbers, have not only met with success, but more importantly have seen concomitant declines in HIV. These successes have been used to support the theory that MCP is a key driver of the HIV epidemic in the southern African region.

As an hypothesized, major driver of the HIV epidemic in southern Africa, the concurrency theory is relatively new. Therefore research is urgently needed to inform whether MCP are indeed directly responsible for the persistence of high levels of HIV in southern Africa, and/or whether MCP is

indirectly linked to HIV transmission via other HIV-related risk behaviours. Second generation HIV BBSS among adult men who have multiple, concurrent female sexual partners has the ability to address these questions, and thus to assist in crafting timely, appropriate responses.

In 2006 a second generation HIV BBSS surveillance survey was conducted among a subpopulation in South Africa: high-risk heterosexual (HRH) adult men who have multiple female sexual partners. This was the first known BBSS conducted among a HRH male subpopulation. In 2008 two further BBSS were conducted among the same subpopulation of HRH men; one a repeat cross-sectional survey in the same setting, the other a cross-sectional survey in another, comparative setting. Both settings, situated 20 and 40 kilometers from Cape Town, South Africa respectively are peri-urban settlements characterized by endemic poverty, unemployment and elevated risk for HIV.

This thesis reports on the three second generation BBSS conducted in 2006 and 2008 and a qualitative study conducted in 2006 among the high-risk subpopulation of HRH. The BBSS are the first known studies to be conducted among HRH men internationally. The BBSS employed respondent-driven sampling (RDS) to recruit HRH men: a sampling methodology that has been successfully used in surveillance studies among other hard-to-reach, high risk populations internationally. Twenty men were purposively sampled during the 2006 BBSS to participate in in-depth interviews. Results from these studies are presented in the form of five published papers and one paper under review.

The first paper reports on data from the 2006 BBSS. It describes HIV prevalence and behavioural risk factors associated with HIV. Results showed that HIV prevalence was 12.3% and being older than 24 years and not using a condom during last sexual intercourse with a one-time partner were significantly associated with HIV infection.

The second paper used data from two BBSS conducted in one study setting in 2006 and 2008. It examined the effectiveness of RDS to recruit HRH men, and reported differences in HIV-related risk behaviours between the two time points. RDS was found to be an effective and feasible strategy for recruiting hard-to-reach HRH men into BBSS. Between 2006 and 2008 there were significant differences in condom use with main sexual partners; numbers of sexual partners; and alcohol consumption; all of which had improved between the two time points.

The third paper used data from the BBSS conducted in 2008 in a different study setting, among the same HRH subpopulation. This paper describes HIV risk behaviours and their relationship to

intimate partner violence (IPV). Findings showed that IPV and HIV-related risk behaviours among HRH men are intricately interwoven, providing fertile ground for increased HIV vulnerability.

The fourth paper used in-depth interview data from qualitative interviews conducted in 2006 that examined the use of alcohol as a currency in casual, transactional sexual relationships. Findings highlighted the latent association between alcohol and transactional sex and provided an in-depth examination of the normative role that alcohol plays in the formation of casual sexual partnerships characterized by exchange. The paper concluded by building on an existing conceptual model that traces the potential pathways by which alcohol use and transactional sex are linked to sexual risk behaviors.

The fifth paper used data from the two BBSS conducted in 2008 in two different study settings, among the same HRH subpopulation. The paper reports on the associations between alcohol misuse and risks for HIV infection. Findings showed that problem alcohol use among HRH men is strongly linked to a number of other HIV-related risk behaviours, providing answers to questions posed by an international expert panel in their continuing attempt to demonstrate a causal link between problem alcohol use and HIV.

The final paper critically examined HIV prevention and risk reduction interventions that have been conducted and evaluated among heterosexual adult males, in low- and middle-income countries. On the whole, men responded best to information-behaviour-motivational models of behaviour change, whether conducted as individual or group sessions. Large-scale, community-based interventions had varying effects on mens' behaviours. The paucity of evaluated interventions for heterosexual men suggests that adult men remain underrepresented as targets in prevention efforts.

The final chapter of the thesis draws on the results reported in the above papers and provides a compelling argument for regular, second generation BBSS among HRH men. The results also suggest that HIV prevention efforts among HRH men should focus on reducing the number of sexual partners, consistent condom use, and reduction in alcohol consumption and gender-based violence. Despite the fact that RDS was found to be a feasible and effective strategy for recruitment of HRH men into BBSS, a critical examination of RDS detailing this sampling methodology's strengths and limitations is provided. Similar second generation BBSS among HRH in other settings in South Africa are critical for an informed and effectively funded response to the continuing HIV burden in this country.

ACKNOWLEDGEMENTS

I would like to express my thanks and gratitude to the following people and institutions who have supported me during the work comprising this thesis:

- My supervisors, the late Alan Flisher who travelled the long journey with me, and whose wisdom and unfailing support is sadly missed; and Cathy Mathews who so competently supported me throughout, and particularly in the final stages of this thesis.
- For the paper on the feasibility of respondent-driven sampling and differences in risk behaviour/s over time, I thank Lisa Johnston for her support and insights.
- For the paper on the association between risk behaviour and intimate partner violence, I thank Rachel Jewkes for her inspiration and invaluable advice.
- For the paper on HIV risk and problem alcohol use, I thank Charles Parry for sharing his extensive experience with me.
- For the paper on alcohol as currency in sexual exchange relationships, I thank Anders Ragnarsson for his excellent job with data collection and Cathy Mathews for sharing her expertise with analysis of qualitative data.
- For the systematic review of HIV interventions for heterosexual men, I thank Cathy Mathews for her insight and advice, and Yanga Zembe who was constantly available with encouragement.
- I acknowledge with gratitude the funding provided for the studies from Centers for Disease Control and Prevention, and the Western Cape Department of Health.
- I thank Columbia University-Southern African Fogarty AIDS International Training and Research Program (AITRP) funded by the Fogarty International Center, National Institutes of Health (grant X D43TW00231) (May to July 2010) for the opportunity this fellowship provided me to concentrate on writing the final pieces of the thesis.
- For the opportunity to create this thesis from the work I was doing in the Health Systems Research Unit at the Medical Research Council, I thank all those who facilitated the opportunity.
- Finally I would like to extend heartfelt thanks to my husband, John, friends and family who have supported me throughout the production of this thesis.

PREFACE

This thesis includes published papers, as per general provision 6.7 in the General Rules for the Degree of Doctor of Philosophy (PhD) of the University of Cape Town, and with the approval of the University Doctoral Degrees Board. The following six papers are formally included as part of the thesis:

1. Chopra, M., Townsend, L., Johnston, L., Mathews, C., Tomlinson, M., O'Bra, H. & Kendall, C. (2009). Estimating HIV prevalence and risk behaviors among high-risk heterosexual men with multiple sex partners: use of respondent-driven sampling. *Journal of Acquired Immune Deficiency Syndromes*, 51,72-77.
2. Townsend, L. Johnston, L.G., Flisher, A.J., Mathews, C. & Zembe, Y. (2010) Effectiveness of respondent-driven sampling to recruit high risk heterosexual men who have multiple female sexual partners: Differences in HIV prevalence and sexual risk behaviors measured at two time points. *AIDS & Behavior*. doi: 10.1007/s10461-010-9753-5
3. Townsend, L., Jewkes, R., Mathews, C., Johnston, J.G., Flisher, A.J., Zembe, Y. & Chopra, M. (2010). HIV risk behaviours and their relationship to intimate partner violence (IPV) among men who have multiple female sexual partners in Cape Town, South Africa. *AIDS & Behaviour*, doi:10.1007/s10461-010-9680-5
4. Townsend, L., Rosenthal, S.R., Parry, C.D.H., Zembe, Y., Mathews, C. & Flisher, A.J. (2010). Associations between alcohol misuse and risks for HIV infection among men who have multiple female sexual partners in Cape Town, South Africa. *AIDS Care*. doi: 10.1090/09540121.2010.482128
5. Townsend, L., Ragnarsson, A., Mathews, C., Johnston, L.G., Ekström, A.M., Thorson A. & Chopra, M. (2010). "Taking Care of Business": Alcohol as Currency in Transactional Sexual Relationships Among *Players* in Cape Town, South Africa. *Qualitative Health Research*. doi:10.1177/1049732310378296
6. Townsend, L., Mathews, C., Zembe, Y. & Flisher, A.J. A systematic review of behavioural interventions to prevent HIV infection and transmission among heterosexual, adult men in low- and middle-income countries (Prevention Science - under review)

The contribution of the candidate is discussed as part of an introduction to each paper contained in Chapter 2. In summary, the candidate is the lead and corresponding author in all but one of the included papers. All first-authored papers were drafted and revised by the candidate. All co-authors critically reviewed and approved the submitted manuscripts and any comments were assessed by and where appropriate integrated by the candidate. The candidate was instrumental in all drafts and revisions of the second authored paper.

ABBREVIATIONS

ACASI	Audio computer assisted self interview
AIDS	Acquired immune deficiency syndromes
ANC	Antenatal clinic
BBSS	Biological and behavioural surveillance survey
CSW	Commercial sex worker
DHS	Demographic health survey
FTFI	Face-to-face interview
HIV	Human Immunodeficiency virus
HRH	High-risk heterosexual
IDU	Injecting drug user
IPV	Intimate partner violence
KABP	Knowledge, attitudes, behaviour and practices
MARP	Most at risk population
MCP	Multiple, concurrent partners
MSM	Men who have sex with men
NSP	National strategic plan
NGO	Non-government organization
NHBS	National HIV Behavioural surveillance system
NBHS-HET-1	National HIV Behavioural surveillance system; heterosexuals; round 1
PEPFAR	President's emergency programme for AIDS relief
RDS	Respondent-driven sampling
SAQ	Self-administered questionnaire
STI	Sexually transmitted infection
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNGASS	United Nations General Assembly Special Session
USA	United States of America
WHO	World Health Organization

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION AND BACKGROUND

INTRODUCTION.....	1
BACKGROUND.....	2
HIV/AIDS and the global response to the epidemic.....	2
HIV surveillance data.....	3
Biological data.....	4
Behavioural data.....	5
Biological and behavioural data.....	6
Second generation HIV surveillance.....	6
Recruiting most at risk populations (MARPs) for second generation HIV surveillance.....	7
Sampling methods for hidden and hard-to-reach subpopulations.....	8
Respondent-driven sampling.....	9
Behavioural indicators for HRH subpopulations.....	12
Multiple, concurrent sexual partnering (MCP).....	13
Age-disparate and intergenerational sexual relationships.....	14
Low and/or incorrect condom use.....	15
Intimate partner violence (IPV).....	15
Problematic alcohol use.....	16
Conclusion.....	17
BACKGROUND: SOUTH AFRICA.....	18
Heightened vulnerability to HIV among subpopulations in South Africa.....	18
Risk behaviours for HIV infection and transmission in South Africa.....	21
Multiple, concurrent sexual partnering.....	21
Age disparate sexual relationships.....	22
Inconsistent condom use.....	22
Intimate partner violence.....	23
Problem alcohol use.....	23
Second generation HIV surveillance using RDS among HRH men in	

South Africa.....	24
The reach and effect of national HIV prevention programmes in South Africa.....	24
AIMS AND OBJECTIVES OF THE THESIS.....	26
METHODS.....	27
Study settings.....	27
Khayelitsha.....	28
Khayamandi.....	29
Formative research.....	29
Recruitment coupons.....	30
Ending RDS.....	31
ETHICAL CLEARANCE.....	33

CHAPTER 2: RESULTS IN THE FORM OF PUBLISHED PAPERS

Effectiveness of respondent-driven sampling to recruit high risk heterosexual men who have multiple female sexual partners: Differences in HIV prevalence and sexual risk behaviors measured at two time points.....	35
Estimating HIV prevalence and risk behaviors among high-risk heterosexual men with multiple sex partners: use of respondent-driven sampling.....	42
HIV risk behaviours and their relationship to intimate partner violence (IPV) among men who have multiple female sexual partners in Cape Town, South Africa.....	53
Associations between alcohol misuse and risks for HIV infection among men who have multiple female sexual partners in Cape Town, South Africa.....	64
“Taking Care of Business”: Alcohol as currency in Transactional sexual relationships among <i>Players</i> in Cape Town, South Africa.....	76
A systematic review of behavioural interventions to prevent HIV infection and transmission among heterosexual, adult men in low- and middle-income countries.....	88

CHAPTER 3: CONCLUSIONS, LIMITATIONS AND FUTURE DIRECTIONS..... 122

SECOND GENERATION SURVEILLANCE AMONG HETEROSEXUAL MEN.....	122
HIV RISK BEHAVIOURS AMONG HETEROSEXUAL MEN.....	123
THE RELATIONSHIP BETWEEN RISK BEHAVIOURS AND HIV.....	124

EVIDENCE FROM BBSS FOR TARGETED HIV PREVENTION INTERVENTIONS.....	126
CHALLENGES IN COLLECTING SEXUAL BEHAVIOUR DATA.....	127
Self-preservation bias.....	128
Social desirability.....	128
Recall bias.....	129
Modes of questionnaire administration.....	129
Validation of sexual behaviour question responses.....	130
Conclusion.....	131
LIMITATIONS OF RDS.....	131
Analytical limitations.....	131
Incentives.....	133
Recruitment coupon numbers.....	134
STRENGTHS AND LIMITATIONS OF BBSS STUDIES IN KHAYELITSHA AND KHAYAMANDI.....	135
FUTURE DIRECTIONS.....	136
REFERENCES.....	137
 TABLES (excluding those in published papers)	
Table 1. HIV prevalence by race and locality type in South Africa.....	19
Table 2. HIV prevalence by age and gender in South Africa in 2008 (Shisana et al., 2009).....	20
 FIGURES (excluding those in published papers)	
Figure 1. Recruitment patterns: HIV status X marital status. Ten waves of recruitment produced 70 participants from this seed.....	32
Figure 2. Features and manifestations of a model of masculinity that influences risky sexual behaviours among men who have multiple sexual partners.....	125

Chapter 1: INTRODUCTION AND BACKGROUND

1. INTRODUCTION

The aim of this thesis is to develop an effective method of second generation HIV surveillance among heterosexual adult men who have multiple, concurrent female sexual partners and who reside in peri-urban, informal settings in South Africa. Multiple sexual partnering is considered an important contributor to the spread of HIV in generalized HIV epidemic settings and heterosexual men who engage in this behaviour are thus dubbed high-risk, heterosexual men (HRH). Second generation HIV surveillance strengthens existing HIV surveillance systems. By providing the opportunity to measure and analyze linked biological and behavioural data, it provides a detailed depiction of the risk behaviours among survey participants and the relationship of these risk behaviours to HIV serostatus. For HRH men, these behaviours include the extent of multiple sexual partnering, condom use, alcohol misuse, intimate partner violence and transactional sex. Repeated cross-sectional HIV biological and behavioural surveillance surveys among the same subpopulation of HRH men, in the same and in different settings, provides a means to assess trends in HIV-related risk behaviours and HIV prevalence among them over time and across settings. In addressing the thesis aims, the effectiveness of respondent-driven sampling (RDS) as a strategy to sample HRH men is also examined. RDS is a methodology used to access hard-to-reach and hidden subpopulations that are at increased risk of HIV infection. Some subpopulations are hard to reach because of their diverse distribution in the general population in relatively small number; others are hidden and thus also hard to reach because their behaviours are negatively socially sanctioned or illegal. Thus hard-to-reach and hidden subpopulations are very difficult to access during existing sentinel site and household surveillance surveys. Findings from biological and behavioral surveillance data collected from HRH men are vitally important for the development and evaluation of targeted HIV risk reduction interventions among them.

This thesis reports on three HIV biological and behaviour surveillance surveys (BBSS) and a qualitative, individual interview study conducted among a population of HRH men. These BBSS are the first in South Africa to be conducted among this high-risk subpopulation. They

Chapter 1: Introduction and background

used respondent-driven sampling (RDS) to recruit men and are among the first internationally to use this sampling strategy to recruit heterosexual people. Twenty men were purposively sampled during one of the BBSS to participate in in-depth interviews. This chapter presents an overview of the global HIV/AIDS burden and the international response to the epidemic; the importance of second generation HIV surveillance particularly in light of the global economic crisis; challenges and strategies for sampling subpopulations at high risk for HIV infection; the South African HIV/AIDS burden and response; and the rationale for second generation HIV surveillance among South African, HRH men aged between 25 and 55 years who have multiple, concurrent sexual partners. The chapter will then present the aims and specific objectives of the thesis and conclude with expanded detail on parts of the studies' procedures and methodology that, for the sake of parsimony, were excluded or only briefly described in the published papers contained in Chapter 2. These include the rationale for choosing the studies' settings for BBSS; a description of formative research conducted prior to the surveys; and the way in which uniquely numbered recruitment coupons were used to monitor recruitment of participants.

2. BACKGROUND

2.1. HIV/AIDS and the global response to the epidemic

As of 2008 the global HIV/AIDS epidemic saw 33.4 million people infected with HIV, 2.7 million becoming newly infected, and two million dying of AIDS-related causes during 2008 (UNAIDS, 2009a). The global burden of HIV/AIDS remains an unprecedented, global emergency and has demanded and will continue to demand, a united and concerted international response. The response to date has seen national and international investment in fighting the global HIV/AIDS epidemic rising considerably from just under U.S.\$1.6 billion in 2001 to U.S.\$13.8 billion in 2008 (Izazola-Licea, Wiegmann, Arán, Guthrie, De Lay & Avila-Figueroa, 2009). Despite this dramatic trajectory in funds, the estimated global requirement of U.S.\$25 billion is unlikely to be met and this is exacerbated by the global economic crisis and "donor fatigue" (Médecins Sans Frontières, 2010).

Chapter 1: Introduction and background

According to a recent UNAIDS report, the economic crisis has seen a decrease in both demand for and supply of HIV/AIDS-related services (UNAIDS, 2009b). Decreased demand as a result of decreases in household incomes mostly due to increases in unemployment, and decreased supply as a function of decreases in government revenues, in international donor funding and in currency devaluations, and thus available resources (UNAIDS, 2009b). As of July 2009, 59% of 63 countries' UNAIDS Country Coordinators in low- and middle-income countries expected a negative impact on their respective country's prevention programmes, and 21% reported adverse effects on their antiretroviral treatment programmes (UNAIDS, 2009b). The decreases in international funding in particular is having a discernible, negative effect on HIV programmes in almost all low- and middle-income countries (UNAIDS, 2009b). This is not unexpected given that a survey of 50 low- and middle-income countries showed that overall, 70% of HIV spending came from international sources, and in 17 low-income countries it was as high as 87% (Izazola-Licea et al., 2009). The result will likely be increases in HIV infection and AIDS-related deaths, mostly in low- and middle-income countries where the burden of the HIV/AIDS epidemic is at its heaviest.

With the dramatic increase in funding from 2001 reported above, came a greater demand for accountability, trend analysis, and impact evaluation from recipients of HIV-related funding and programmes, both at the within-country and international levels (Diaz, Garcia-Calleja, Ghys & Sabin, 2009). However, with the more recent decline in real and expected resources available for the fight against HIV/AIDS, the need for accountability, trend analysis and impact evaluation has become even more urgent and salient. One of the ways in which these demands can be met and perhaps influence the allocation and optimal use of much needed (scarce) funding and resources, is through collection of surveillance data (Izazola-Licea et al., 2009; Rehle, Lazzari, Dallabetta & Asamoah-Odei, 2004). Surveillance data are critical for these types of analyses (Diaz et al., 2009).

2.2. HIV surveillance data

Applying the definition of public health surveillance, HIV surveillance refers to the "...ongoing, systematic collection, analysis, and interpretation of [HIV-related data] essential to the planning, implementation, and evaluation of [HIV-related] public health practice,

closely integrated with the timely dissemination of these data to those responsible for prevention and control” (Centers for Disease Control & Prevention, 2009). In 1996 the UNAIDS / WHO Working Group of HIV/AIDS and STI surveillance was established, and continues to compile the best HIV-related information available at regional, national and global levels. This working group systematically collates such data, disseminates them for informed decision-making and planning, and where necessary assists in quality improvement of data (UNAIDS, 2000). HIV surveillance systems collect different types of data from different populations. Two of the most common data types are biological and behavioural.

2.2.1. Biological data

Biological serosurveillance involves the collecting and screening of blood samples from a number of sources such as pregnant women at antenatal clinics (ANC), patients attending sexually transmitted infection (STI) health facilities, and people who donate blood. In these instances blood is drawn routinely, and unlinked, anonymous HIV screening is conducted on such samples. The challenge with these data is knowing whether the population being tested for HIV is representative of the population from which it comes, or of the general population (Rehle et al., 2009; UNAIDS, 2000).

ANC surveillance has been conducted since the 1980’s internationally, and has been used extensively to estimate HIV prevalence in adult populations (Rehle et al., 2004). Pregnant women attending ANC are the most accessible cross-section of healthy, sexually active women in the general population and have become the most-used for HIV surveillance in developing countries, particularly where HIV epidemics are classified as generalized (UNAIDS, 2000). For example, in the WHO Africa region 738 096 pregnant women were screened for HIV at various points in time between 2000 and 2006, and in 2006 there were just under 2500 ANC sites in the region (WHO, 2008). However, whilst useful, seroprevalence data from ANC sentinel sites are not without biases. These biases include the possibility of sentinel sites not having been randomly selected; differential access and coverage of ANC services, particularly between urban and rural settings; different HIV-

related risk behaviours among those who attend ANCs; lower fertility among HIV-infected women; and other socio-demographic factors (Rehle et al., 2004).

Despite these difficulties, ANC surveillance continues to serve well in tracking HIV prevalence and informing intervention and prevention programme development, and national and international policy decisions. What ANC data are not able to provide, however, is explanations for the diversity of HIV epidemics around the world, between and within countries, or changes over time in mature epidemics that have become increasingly evident in the past ten years (UNAIDS, 2000). Further, because ANC data are unlinked, they are of no use in understanding behaviours that contribute to HIV infection (Diaz et al., 2009).

2.2.2. Behavioural data

Another type of surveillance data comes from cross-sectional behavioural surveys conducted among members of the general population (UNAIDS, 2000). In these surveys, people typically provide informed consent and answers to questions about their knowledge, attitudes, behaviours and practices (KABP). KABP surveys have been conducted in developing countries since the 1980s (UNAIDS, 2000). However, while KABP data are useful for assessing levels of KABP in the general population, and therefore provide an indication of what KABP may be impacting on the spread of HIV, they too are not without biases and challenges.

First, having to obtain consent from participants presents the possibility of a systematic bias based on refusals to participate. Similarly, having to obtain consent from participants whose behaviour/s are stigmatized, socially negatively sanctioned or illegal also presents the possibility of systematic bias based on refusals to participate. Second, in contexts where HIV is transmitted by means of sexual behaviour, behavioural surveys rely on self-report on sexual KABP and are prone to under- or over-reporting because the KABP enquired about are socially negatively (or positively) sanctioned. Third, subpopulations that are at high risk of HIV may not be captured in sufficient numbers in general population surveys. Finally, behavioural data that are unlinked to individual HIV status does not provide information about what KABP are associated with HIV serostatus, and therefore what KABP are likely

driving the epidemic. Ideally, simultaneous collection of biological and behavioural data would overcome the limitations of solely biological or behavioural data as outlined above, and provide a more detailed picture of the HIV epidemic at national, regional and global levels.

2.2.3. Biological and behavioural data

Demographic health surveys (DHS) began in the early 1980's. Variables addressing HIV were added to the DHS in 1988, and HIV testing was introduced in 2001 to meet the need for linked biological and behavioural data (PEPFAR, 2009). DHS collects both biological and behaviour data from a representative sample of the general population. However, serotesting on a national level is expensive and is a logistically complex undertaking (Rehle et al., 2009). Furthermore national, population-based surveys are usually not collected at intervals close enough to allow for timely responses to changes in epidemic patterns (Rehle et al., 2009). An alternative would be to include behavioural surveillance among pregnant women at existing ANC sentinel sites. However, this strategy is also not without difficulties. Enquiring from women in the late stages of pregnancy about risky sexual behaviours and condom use would likely not yield information that is typical of the general population (Rehle et al., 2009). Because the collection of biological and behavioural data is essential for countries to know their epidemic and thus know how to respond (UNAIDS, 2008a), the call to strengthen existing surveillance systems is of utmost importance.

2.3. Second generation HIV surveillance

Strengthened surveillance systems (called, second generation HIV surveillance systems) build on existing systems as outlined above; tailoring them to individual countries' epidemic patterns, thus increasing their explanatory power and making better use of the information they generate (UNAIDS, 2000). To this end UNAIDS guidelines for second generation HIV surveillance recommend the following:

- Sentinel surveillance among pregnant women, in urban and rural settings,
- Cross-sectional surveys of behaviour in the general population,
- Cross-sectional surveys among young people,
- HIV and behavioural surveillance in subpopulations with high-risk behaviour, and

- Data on morbidity and mortality (UNAIDS, 2000).

Of relevance to this thesis is the recommendation to concentrate data collection among subpopulations most at risk of HIV infection and transmission, and supplementing the collection of biological data with information about their HIV-related risk behaviours. Diaz et al., (2009) and Magnani, Sabin, Saidel, and Heckathorn (2005) go further to recommend the development of robust surveillance systems that will establish an association between behaviour and HIV prevalence at the community level, by collecting data from the same source population at regular intervals. In particular, the source population would be one in which members engage in high-risk, HIV-related risk behaviours, and although large enough to have a meaningful influence on the spread of HIV, too small and diversely distributed in the general population to be captured in sufficient numbers. In this way an increased understanding of the HIV epidemic and behaviours that spread HIV and sustain the epidemic would be possible from a combined analysis of behavioural and biological data. These recommendations are timely, given the call for greater accountability, trend analysis and impact evaluation from HIV funding as described above.

2.4. Recruiting most at risk populations (MARP) for second generation HIV surveillance

The point has been made previously that second generation surveillance should ideally be conducted among subpopulations most at risk of HIV. Among the international HIV community most at risk populations (MARPs) have been defined as commercial sex workers (CSW), injecting drug users (IDU) and men who have sex with men (MSM) (PEPFAR, 2009; USAID, 2009). MARPs have been thus defined because they engage in behaviours that put them at higher risk for HIV and usually have a higher than average HIV prevalence compared to people in the general population (UNAIDS, 2006). This classification is, and continues to be relevant for countries that have concentrated and low-level HIV epidemics, where HIV is concentrated in groups of people who engage in behaviours that elevate their risk of HIV (Abdool Karim, Abdool Karim, Gouws & Baxter, 2007). However, it overlooks the presence of other high risk sub-populations in countries that have generalized epidemics, where HIV is mostly spread through unprotected heterosexual intercourse and where HIV prevalence in the adult population is firmly established in the general

population (Abdool Karim et al., 2007). In these instances, high-risk subpopulations are likely to be diversely distributed within the general, sexually-active heterosexual population presenting challenges for recruiting such subpopulations into community-level, HIV biological and behavioural surveillance surveys.

First, population-based household surveys, unless very large, may not capture a sufficient number of the high-risk subpopulation of interest to enable accurate conclusions to be drawn about them. Furthermore, if the information required in a household survey is secretive or socially-negatively sanctioned, perceiving a lack of privacy, anonymity or confidentiality, respondents may not provide truthful responses to such questions (Gregson, Zhuwau, Ndlovu & Nyamukapa, 2002; Weir, Tate, Zhusupov & Boerma, 2004). Second, many high-risk subpopulations are hidden and thus hard to reach. They are hidden in that no sampling frame exists for them and the behaviours they engage in are often illegal, illicit or socially unacceptable (Magnani et al., 2005).

2.5. Sampling methods for hidden and hard-to-reach subpopulations

Other sampling methods used to recruit hidden and hard-to-reach subpopulations include snowball sampling, facility-based sampling, and time location sampling (Kendall et al., 2008; Magnani et al., 2005). While these methods all provide feasible and practical strategies for accessing and recruiting hard-to-reach subpopulations (particularly in resource-constrained settings), they are unlikely to provide a representative sample of the targeted subpopulation. For example, in snowball sampling, the reliance on initial recruiters to recruit members of the target subpopulation often results in the ensuing sample being more representative of the initial recruiters than the subpopulation of interest (Kendall et al., 2008; Magnani et al., 2005). Both facility-based and time location sampling rely on the subpopulation of interest being accessible at a particular facility or venue. However, unless all or a very high percentage of facilities or venues are identified and/or all or a high percentage of the target subpopulation is present at the facilities or venues, these methods will not capture a representative sample of them (Kendall et al., 2008; Magnani et al., 2005). Furthermore, in the case of time-location sampling, unless members of the subpopulation are also present during the predetermined time of recruitment, significant numbers of them could be

excluded from the sample (Kendall et al., 2008; Magnani et al., 2005). As an alternative to these methods, Respondent Driven Sampling (RDS) combines a modified form of snowball sampling with a mathematical model that weights the sample in such a way as to counteract bias introduced by the non-random manner in which participants recruit each other (Heckathorn, 1997, 2002, 2007).

2.6. Respondent-driven sampling

RDS is a form of chain referral sampling that allows us to obtain a “probability” sample (Heckathorn, 2002; Salganik & Heckathorn, 2004). RDS requires starting with a pre-determined number of initial contacts or “seeds” who meet the eligibility criteria for the survey. After the seeds participate in the survey, they become recruiters who are given a fixed number of recruitment coupons, usually three, with which to invite people from their network of friends or acquaintances who meet the eligibility criteria to participate in the survey. The survey is conducted at a fixed site, identified on a recruitment coupon. Once each seed’s recruits have participated in the survey, they are also given a fixed number of coupons and asked to invite people from their social networks to participate in the survey. This recruitment process continues through a number of recruitment cycles or waves until the required sample size or equilibrium is reached. According to RDS theory, equilibrium is the point in data collection at which the hypothetical population proportions on all or selected key variables do not change by more than 2%, no matter how much the sample proportions change as a consequence of more individuals entering into the sample (Heckathorn 1997, 2002).

The central feature of RDS that distinguishes it from snowball sampling is that the seeds recruit only a limited number of respondents thereby limiting their influence on the final sample composition. Limiting the number of recruits that each seed and each recruit can enlist into the study also allows for long referral chains that “reach” further into the hidden population of interest. The RDS procedure also requires that the linkages between recruiters and recruits are tracked, thereby allowing for recruitment biases to be assessed and adjusted for in analysis of the data. It also requires extracting information about each respondent’s

personal network size. This allows for weighted analysis to offset the effects of over-sampling of respondents with larger social networks.

RDS is increasingly being used to sample hidden and hard-to-reach, high-risk subpopulations, internationally. In its support for high-quality surveillance data from “...high-risk populations in the community” in resource-constrained settings, the United States President’s Emergency Plan for AIDS Relief (PEPFAR) provides technical support and funding to a number of countries for the development of new surveillance methods (PEPFAR, 2009). To this end, together with other international partners and national governments, PEPFAR has provided the necessary skills to local surveillance administrators to use RDS to reach hard-to-reach and hidden, high-risk subpopulations in 13, resource-constrained countries globally (PEPFAR, 2009). As noted earlier, these high-risk populations continue to be MSM, CSW (now referred to as people in prostitution in this PEPFAR report), and IDU. However, PEPFAR now include high risk heterosexual men among these traditional classifications of high-risk population (PEPFAR, 2009): a timely and welcome extension to MARPs that is especially relevant for HIV transmission risk in generalized epidemics.

A recent review of 123 cross-sectional studies conducted internationally concluded that RDS was an effective strategy to sample high-risk, hard to reach and socially networked populations for HIV biological and behavioural surveillance (Malekinejad, Johnston, Kendall, Kerr, Rifkin & Rutherford, 2008). Published literature documenting repeat cross-sectional surveys in the same high-risk population using RDS is scarce, but should begin to emerge as more countries use this strategy in repeat BBSS surveys over time. To date, only one published article reports on repeat cross-sectional surveillance studies that used RDS. In Beijing, China RDS was used to recruit MSM for biological and behavioural surveys in three successive years; 2004, 2005 and 2006 (Ma et al., 2007). The authors concluded that RDS had been successful in recruiting large samples of this high-risk subpopulation into the three surveys in short periods of time. Despite implementation problems during some of the surveys, the authors were able to suggest, with some degree of confidence, trends in HIV infection and risk behaviours over time among MSM in this city: an increase in HIV

Chapter 1: Introduction and background

prevalence, syphilis, self-reported history of STIs, multiple sexual partners, and low consistent condom use (Ma et al., 2007).

None of the 123 studies included in the aforementioned review were conducted among high-risk heterosexual (HRH) men. However, a limited amount of published literature has recently emerged from round 1 of the National HIV Behavioral Surveillance System for Heterosexuals (NHBS-HET-1) conducted in the United States of America (USA) (Denning & DiNenno, 2010). The fact that 32% of HIV/AIDS cases in the United States were attributed to heterosexual contact in 2005, prompted the need for behavioral surveillance among heterosexuals at risk for infection (Lansky, 2009). The surveys used RDS and venue-based sampling to recruit a total of 9078 heterosexual men and women residing in high risk areas (i.e. census tracts with high rates of poverty and HIV) in 25 cities in the USA. They were conducted between 2006 and 2007 and comprised interviews and HIV testing among men and women between 18 and 50 years who had an opposite gender sexual partner in the past year and who were not MSM, IDUs, CSWs or clients of CSWs. HIV prevalence from the combined findings from 23 cities was 2.1%, 20 times higher than in the general USA population (0.1%) (Denning & DiNenno, 2010). Results from Houston (Risser, Padgett & Richards, Rehman & Wolverton, 2007), Washington D.C. (Magnus et al., 2009), San Francisco (Arnold, Fisher & McFarland, 2009), and New York City (Neaigus, Jenness, Haga, Murrill & Wendell, 2009) found that heterosexuals residing in high risk areas in these cities had high rates of concurrent sexual partners, high rates of unprotected sex, and high rates of STIs. On the whole, these studies found that, compared to heterosexual men in the general population, subgroups of high risk heterosexual men were poorer, used condoms less frequently, had less access to information about risk for HIV and safe sex, and were more likely to be governed by and condone hierarchical gender relations.

With data such as these and the recognition among the international funding community that subgroups of heterosexual men in the general, global population constitute a subpopulation at high risk of HIV, it is likely there will soon be an increase in related data emerging globally. As has been noted previously, the diversity of the HIV epidemic points to the probable different risk behaviours among different between- and within-country

subpopulations. The challenge for surveillance among HRH people, and men in particular, will be whether to doggedly measure only those behaviours recommended by the United Nations General Assembly Special Session on HIV/AIDS (UNGASS) (UNAIDS, 2009c), or whether to supplement them with other, more salient behavioural indicators; indicators that will allow a meaningful analysis of the role that different risk behaviours engaged in by different subpopulations plays in the spread of HIV in different parts of the world.

2.7. Behavioural indicators for HRH subpopulations

UNGASS recommends measuring the following behaviours: sexual debut, numbers of sexual partners in the 12 months prior to a survey, and condom use at last sex with various types of sexual partners (for example, regular partners, casual partners) (UNAIDS, 2010). From these measures, the UNGASS reporting guidelines indicate ways in which to compute (risk) behaviour indicators. The high prevalence of other risk behaviours that are directly and indirectly associated with risk for HIV infection are thus ignored. These behaviours include concurrent rather than merely multiple sexual partnering, age-disparate sexual relationships, condom use other than at last sex only; high or problematic levels of alcohol consumption; and intimate partner violence

2.7.1. Multiple, concurrent sexual partnering (MCP)

One of the risk behaviours thought to be a significant factor in the spread and persistence of HIV in southern Africa is multiple, concurrent sexual partners (MCP): a behaviour that has received a great deal of recent attention and debate (Epstein, 2008, 2010; Green, Mah, Ruark & Hearst, 2009; Halperin & Epstein, 2004; Lurie & Rosenthal, 2010; Mah & Halperin, 2010a & b; Morris, 2010; Shelton, 2007, 2009; Soul City, 2008; UNAIDS, 2008). MCP has been inconsistently defined and measured in the literature to date (Nelson et al., 2007), but is generally considered to be instances where an individual has two or more sexual relationships that overlap in time (UNAIDS, 2009d). This individual and his or her sexual partners form a sexual network.

At the individual level, acute HIV infection during the three to twelve weeks after infection when viral load is high, plays an important role in the spread of HIV to other members of

the sexual network. It is during this stage of infection that the probability of heterosexual transmission of HIV increases between eight- and ten-fold per sex act compared to infection during the chronic phase of HIV (Pilcher et al., 2004). The newly-infected person in the concurrent sexual network places every other member of the network at elevated risk of acquiring HIV during this phase. At the population level, mathematical modelling shows that when any of the members of the sexual network are also engaging in concurrent sexual partnerships, they in turn place members of their other network at increased risk. The outcome is an acceleration in the speed of HIV transmission facilitating the spread of HIV (Halperin & Epstein, 2007; Mah & Halperin, 2010a; Morris & Kretzschmar, 1997), across interlinked sexual networks (AIDS Support and Technical Assistance Resources Project, 2009; Halperin & Mah, 2004). Indeed, Green et al., (2009) suggest that the riskiest concurrent partnerships are those that occur when both partners engage in the behaviour, and it is common in the setting.

Consensus seems to be that MCP is common in many settings in southern Africa (Colvin, 1998; Parker, Makhubele, Ntlabati & Connolly, 2007; Mah, 2008; Mah & Maughan-Brown, 2009; Soul City, 2008), where the behaviour is implicitly acknowledged and tolerated (Mngadi et al., 2009; Leclerc-Madlala, 2009; Mah, 2008; Mah & Maughan-Brown, 2009). Despite the apparently normative nature of MCP, interventions such as in Uganda (Stoneburner & Low-Beer, 2004), Kenya (Shelton, 2007), Zimbabwe (Gregson et al., 2006), Zambia (Sandøy, Dzekedzeke & Fylkesnes, 2010) and other southern African countries (Potts et al., 2008) that have sought to reduce sexual partner numbers, have not only met with success, but more importantly have also seen concomitant declines in HIV. While the declines in HIV in these countries may also have much to do with other, simultaneous prevention efforts such as condom promotion and increases in age of sexual debut, these successes have been used to support the argument that MCP is a key driver of the HIV epidemic in the southern African region.

The hypothesized concurrency theory as outlined above is relatively new, and concentrated surveillance efforts as proposed by Diaz et al., (2009) and Rehle et al., (2009) are urgently needed among those who practice this high-risk behaviour. Such efforts would inform

whether the practice of MCP is indeed directly responsible for the persistence of high levels of HIV in southern Africa, and/or whether MCP is indirectly linked to HIV transmission via other HIV-related risk behaviours. Such efforts would also enable a critical examination of the mathematical modelling methods that have been used to date to make the assumption that MCP are a key driver of the epidemic, and which are the focus of the current debate about the role of MCP in the spread of HIV in sub-Saharan Africa. By providing a body of objective data on the prevalence of MCP and related risk behaviours, the true nature of MCP and the validity of the concurrency theory may follow. Furthermore, HIV BBSS among adult men who have multiple, concurrent female sexual partners has the ability to address these questions, and thus to assist in crafting timely, appropriate responses.

2.7.2. Age-disparate and intergenerational sexual relationships

A review of qualitative and quantitative studies conducted in sub-Saharan Africa found that MCP were often typified by age disparities between (older) men and (younger) women (Luke, 2003). Leclerc-Madlala (2008) distinguished between age-disparate and intergenerational sexual partnerships; the former characterized by age differences of five or more years and the latter by age differences of 10 or more years between sexual partners. While recognizing that age disparities may be equally prevalent in monogamous or serially monogamous sexual relationships, studies conducted in South Africa (Gregson et al., 2002; Jewkes, et al., 2006a; Leclerc-Madlala, 2003, 2008) and in other sub-Saharan African countries such as Uganda (Kelly et al., 2003) and Kenya (Luke, 2005) have demonstrated that the age differences between women and their male partners is a significant HIV risk factor, caused by transmission from older male partners. The tabled HIV prevalence data from the national household survey in South Africa conducted in 2008 (see Table 2 below) clearly demonstrate that HIV infection in women between the ages of 20 and 44 years of age is most likely due to having sexual relations with men who are on average between five and 10 years older than them, i.e. between the ages of 25 and 54 years of age. Leclerc-Madlala (2008) suggests that sexual relationships between older men and younger women are largely driven by men's preference for younger, presumably disease-free partners and women's use of older men to meet a variety of material needs. However, in such relationships, which are also often transactional in nature, women are less likely to be able to negotiate condom use (Abdool

Karim, Sibeko & Baxter, 2010; Leclerc-Madlala, 2008). Jewkes and colleagues found that it was in relationships marked by substantial age differences (five years or more) that communication was poorer, and the likelihood of women being able to suggest condom use was lower (Jewkes et al., 2006a).

2.7.3. Low and/or incorrect condom use

Correct and consistent use of condoms is one of the most reliable methods to prevent sexual transmission of HIV (Hearst & Chen, 2004; Shelton, 2006) and has been, and continues to be the cornerstone of HIV prevention efforts globally. The effectiveness of condoms in preventing HIV transmission or acquisition has been estimated to be approximately 90% (Hearst & Chen, 2004). However, despite the pervasive promotion of condoms, a review of condom promotion by Hearst & Chen (2004) concluded that there was no evidence, anywhere in the world, to suggest that a generalized HIV epidemic has been reversed as a result of increased / consistent condom use. The authors of this review suggest a number of reasons why this may be so. First, while measures of condom use might provide some indication of use in general, they may not sufficiently assess use among high risk groups. Second, condoms may be used at last sex (as it is typically measured), but not consistently over time. Furthermore, there is seldom any indication from studies of heterosexual populations whether condoms are used effectively.

2.7.4. Intimate partner violence (IPV)

In 2006 Garcia-Moreno published the results from a World Health Organization multi-site research study that aimed to document the prevalence of IPV among women internationally (Garcia-Moreno, Jansen, Ellsberg, Heise & Watts, 2006). They used data from over 24000 women aged between 15 and 49 years, living in 15 rural and urban sites in 10 countries. They found that between 15% and 71% of women reported lifetime experiences of physical, sexual and/or both physical and sexual violence perpetrated by intimate partners, and between 4% and 54% reporting these experiences in the past year (Garcia-Moreno et al., 2006). Their overall conclusion was that violence perpetrated by these women's intimate partners was widespread and pervasive.

Added to this global information, a growing body of research has provided ample evidence of the strong relationship between IPV and HIV. Women who experience IPV and gender inequality are at greater risk of HIV (Dunkle & Jewkes, 2007; Dworkin, Fullilove & Peacock, 2009). Vaginal tearing and / or abrasions during sexually violent acts substantially increases a women's biological risk of HIV should her partner be infected with the virus. Physically violent acts in themselves are unlikely to have such a direct effect on the vulnerability to HIV for women. However, closely tied to physical (and sexual) violent behaviour/s are other controlling behaviours of men over women, largely informed by underlying, social ideals of masculinity and patriarchy (Morrell & Jewkes, 2010; Wood & Jewkes, 2001) and power differentials between (young) women and (older) male sexual partners (Abdool Karim et al., 2010). In these circumstances, women are unlikely to have any control over the use of condoms, the fidelity of their partners, or the timing of sex. Indeed, even in the absence of violence, women who have less power and control in an intimate relationship have been found more likely to be HIV positive (Dunkle et al., 2004a).

Strikingly, while a great deal of research effort has gone into HIV-related risks for (traditionally-defined) MARPs – CSW, IDU and MSM - none of the literature on these high risk groups has examined the dynamics of IPV and HIV among their populations of MARPs. The recent call by the UNAIDS Outcome Framework for 2009-2011 to address violence against women in one of the nine priority areas identified (UNAIDS, 2009e) is thus not unexpected and timely, and should be routinely addressed in future BBSS, whether among traditionally-classified MARPs, where appropriate, in the general population or among HRH populations. Examining the prevalence of, and other HIV-related risks associated with IPV by means of regular BBSS is one way in which to begin to address this significant gap. Further, information thus gleaned would impact on the design, implementation and evaluation of targeted prevention interventions that address IPV (Abdool Karim et al., 2010; Dunkle & Jewkes, 2007; Dworkin et al., 2009).

2.7.5. Problematic alcohol use

A considerable body of international research and commentary has sought to establish alcohol and problem alcohol use as a factor in the spread of HIV. While evidence that

problematic alcohol use is directly linked to HIV disease progression, the link to HIV acquisition is less direct, albeit equally clear (Parry, Rehm, Poznyak & Room, 2009). The sexual risk for HIV is hypothesized to be mediated by factors such as risk-taking personality dispositions, impaired cognitive processes, expectancies regarding the effects of alcohol, and/or alcohol drinking environments (Cook & Clark, 2005; Morojele et al., 2006). A recent meta-analysis of studies conducted internationally on the association between alcohol use and HIV infection found that alcohol use was statistically significantly related to acquiring HIV (Baliunas, Rehm, Irving & Shuper, 2010). The risk of acquiring HIV was higher among those who consumed alcohol prior to or during sex rather than at any other time, and among binge drinkers compared to non-binge drinkers (Baliunas et al., 2010). Other reviews of studies that examined the link between alcohol use and HIV and/or HIV-related risk have reached similar conclusions: the link between alcohol (mis)use and HIV is clear (Cook & Clark, 2005; Fisher, Bang & Kapiga, 2007; Kalichman, Simbayi, Kaufman, Cain & Jooste, 2007; Shuper, Joharchi, Irving & Rehm, 2009). Whatever the pathways, alcohol not only makes a significant contribution to the global burden of disease (Casswell & Thamarangsi, 2009), but also to the global burden of HIV.

Despite this evidence, Casswell & Thamarangsi (2009) lament the inadequate international focus on alcohol use and alcohol control in countries around the world. These authors suggest that a lack of political will, participation of the alcohol industry in policy formation, and the expansion of alcohol production and marketing are responsible. This last being directed at emerging markets in the developing world and among young people where HIV is most evident. In efforts to reduce the alcohol-related global burden of disease and specifically the alcohol-related burden of HIV, BBSS endeavours must include monitoring of alcohol use and related HIV-related risk, particularly in contexts where HIV prevalence is high, to provide intervention practitioners with sound, evidence-based guidance on policy and practice.

2.8. Conclusion

In conclusion, concentrating surveillance among high-risk segments of the general population will provide greater accountability for HIV-related spending; monitor trends in

HIV prevalence and risky sexual behaviours; assess the magnitude of and changes in the patterns of the HIV epidemic; and assess the impact of prevention programmes (Diaz et al., 2009). Furthermore, and equally importantly, data from such concentrated surveillance efforts would likely inform advocacy, strengthen commitment, mobilize communities, and assist with advocating for sufficient allocation of resources (Rehle et al., 2009). Concentrated BBSS that assesses a broad range of HIV-related risk behaviours and that use RDS to access hard-to-reach HRH men (and other high-risk subpopulations), are critical for informing a future response to the continuing global HIV pandemic.

3. BACKGROUND: SOUTH AFRICA

South Africa continues to have the largest number of people living with HIV in the world with over 5.7 million people infected with the virus (UNAIDS, 2008a). ANC sentinel site surveillance has been conducted in South Africa since the 1990's and more recently, behavioural surveillance has emerged in national household surveys in three-year cycles since 2002 (South African Government, 2010). Although findings from these surveillance sources suggests that national HIV prevalence rates among adults appear to be reaching a peak, they have continued to rise: from 15.6% in 2002, to 16.2% in 2005 and 16.9% in 2008 (UNAIDS, 2009a). Unlike many low- and middle-income countries, the response to HIV and AIDS in South Africa is primarily funded from domestic sources, with 73% of the total HIV-related spending coming from domestic sources (South African Government, 2010). In 2009, the total domestic and development partner spending for HIV and AIDS totalled ZAR17,579 million (approximately US\$2,088 million) (South African Government, 2010).

3.1. Heightened vulnerability to HIV among subpopulations in South Africa

National HIV prevalence rates such as those cited above aggregate prevalence data across age, gender, race, and geographic location thus masking the differential vulnerability to HIV infection that is evident among particular subgroups of people within the general population. There is not only wide interprovincial heterogeneity in HIV prevalence rates (Shaikh, Abdullah, Lombard, Smit, Bradshaw & Makubalo, 2006; Shisana et al., 2009), but

Chapter 1: Introduction and background

also among subpopulations within the general population as is evident in Tables 1 and 2. These Tables extract HIV prevalence data from two national biological and behavioural household surveys conducted by the Human Sciences Research Council (HSRC) (Shisana et al., 2005 & 2009).

The data in Table 1. show that in the age group 15-49 years, HIV prevalence rates are substantially higher among people who identify as “black” than among any other racial group. In urban settings HIV prevalence rates are also substantially higher among people in informal compared to formal settlements; and in rural settings they are marginally higher among formal compared to informal settlements. A meta-analysis of various household surveys conducted in South Africa confirmed these findings (Kleinschmidt, Pettifor, Morris, MacPhail & Rees, 2007).

Table 1. HIV prevalence by race and locality type in South Africa

		%
National HIV prevalence by race (Shisana et al., 2009)	Black	13.6
	White	0.3
	Coloured	1.7
	Indian	0.3
HIV prevalence among 15-49 year olds by locality type (Shisana et al., 2005)	Urban formal	13.9
	Urban informal	25.8
	Rural formal	17.3
	Rural informal	13.9

Age-stratified data from the national household survey conducted by the HSRC in 2008 (Shisana et al., 2009) clearly demonstrate gender and age disparities in national HIV prevalence rates. For example, the peak age-specific HIV prevalence for women is 25-29 years, five to ten years earlier than the peak for men (30-34 years). Furthermore, men between 20 and 24 years have low HIV prevalence rates (5.1%), while prevalence in women in the same age group is almost four times that of males (21.1%). Within gender differences are also evident. HIV prevalence among women in the age group 25-29 years is five times higher than among those aged 15 to 19 years (32.7% vs. 6.7%); and HIV prevalence among

Chapter 1: Introduction and background

men in the age group 30-34 years is ten times higher than men in the 15-19 year age category (25.8% vs. 2.5%).

Table 2. HIV prevalence by age and gender in South Africa in 2008 (Shisana et al., 2009)

AGE in years	MALES %	FEMALES %
15-19	2.5	6.7
20-24	5.1	21.1
25-29	15.7	32.7
30-34	25.8	29.1
35-39	18.5	24.8
40-44	19.2	16.3
45-49	8.4	14.1
50-54	10.4	10.2
55-59	6.2	7.7
60+	3.5	1.8

In sum, subpopulations within the general South African population who have increased vulnerability to HIV infection and transmission are men between the ages of 25 and 54 who have younger female sexual partners; women between the ages of 20 and 54 who have older male sexual partners; people who identify as “black”; and people who live in urban and rural informal settlements. The authors of the recent South African national household survey recognized that high risk heterosexual subpopulations engage in sexual behaviours that comprise a highly efficient network of HIV transmission, and led them to expand the definition of MARPs to include black African men between 25 and 49 and all men older than 50 (Shisana et al., 2009), a position endorsed by the South African Government (2010). The South African national household survey found that black African men between 25 and 49 years of age have the second highest HIV prevalence in the country (23.7%), surpassed only by the rate found among women aged 20- 34 (32.7%).

The challenge is to identify ways to decrease HIV transmission among MARPs. According to the South African Government’s country progress report on the declaration of commitment on HIV/AIDS, this will require sub-level data collection and analysis and tailoring interventions appropriately (South African Government, 2010). Furthermore, one of the priority areas identified by the South African government’s National HIV and AIDS and STI Strategic Plan for South Africa 2007-2011 (NSP) has been monitoring, research, and

surveillance, which includes regular surveillance to monitor impacts and relevance of HIV interventions (South African Government, 2008). HIV research scientists and policy-makers in South Africa are urged to jointly commit to an evidence-based approach to the response to the pandemic in South Africa (Abdool Karim & Abdool Karim, 2010). In this commentary, the authors go on to suggest that this requires development of a common understanding of the drivers of the epidemic at the local and national level, detailed knowledge of the epidemic and priorities for appropriate responses, a move away from international funding agencies' research and prevention priorities, and a substantial increase in national government funding for the HIV research community (Abdool Karim & Abdool Karim, 2010). These initiatives would indeed identify evidence-based ways to decrease HIV transmission among MARPs in this country.

3.2. Risk behaviours for HIV infection and transmission in South Africa

Mirroring much of the literature described above regarding risk behaviours for HIV, a number of sexual risk behaviours thought to be key drivers of the HIV epidemic in South Africa include concurrent sexual partnerships, intergenerational sexual relationships often characterized by exchange, low condom use, IPV and alcohol (mis)use (Abdool Karim et al., 2010; Jewkes, Dunkle, Nduna & Shai, 2010; Jewkes & Morrell 2010; Kalichman, Simbayi, Kaufman, Cain & Jooste, 2007; Shisana et al., 2009; South African Government, 2010).

3.2.1. Multiple, concurrent sexual partnering (MCP)

Two recent reports have described the extent of MCP in South Africa (Shisana et al., 2009; South African Government, 2010). Both reports assume MCP from a measure that asked merely whether people had "more than one sexual partner in the past 12 months"; one of which suggests that the measure points to partner turnover and can thus be used as a proxy for concurrent partnering (Shisana et al., 2009). While this argument is likely an overstatement, the following information from these reports is presented here in the absence of other reports of rigorously measured MCP. There has been a substantial increase in the percentage of men aged 15-49 years who had sex with more than one partner in the past 12 months, from 19% reporting this behaviour in 2008 to 34% in 2009 (South African Government, 2010). Among women it was reported much lower, but also increasing: from

4% in 2008 to 7% in 2009. The recent South African national household survey found a lower prevalence of reported multiple sexual partnering. However, this report also reported increases in the numbers of people aged 15-49 years reporting more than one sexual partner in the past 12 months between three survey rounds in 2002, 2005 and 2008; from 5.5% (95% CI: 4.8, 6.3) to 9.8% (95% CI: 8.6, 11.3) to 10.6% (95% CI: 9.5, 11.9) (Shisana et al., 2009). This survey also found that men were four times more likely to report this behaviour than women. It also found substantial increases in multiple partners among black African men between 25 and 49 years from 7% in 2002 to 17.4% in 2008, providing further justification for including this subpopulation as a MARP (Shisana et al., 2009).

3.2.2. Age disparate sexual relationships

Age disparate sexual relationships are a feature of many sexual relationships in South Africa. Data from the national household surveys conducted in 2005 and 2008 show that this risk behaviour is increasing among young women (Shisana et al., 2009). In 2005, 18.5% (95% CI: 13.7, 24.4) of women aged between 15 and 19 years reported a sexual partner five or more years older than themselves. This increased considerably to 27.6% (95% CI: 21.7, 34.5) in 2008. Age disparate sexual relationships and MCP are high risk behaviours in themselves. The reported increases found in both these behaviours suggests compounded risk for HIV.

3.2.3. Inconsistent condom use

Findings from three consecutive national household surveys have shown that reporting of condom use at last sex has increased steadily over time, irrespective of gender or age of respondents (Shisana et al., 2009). For example, among men aged 25 to 49 years, condom use increased from 26.7% in 2002 to 35.3% in 2005 and to 56.4% in 2008. Among women increases were from 19.7% to 29.1% and 58.1%. While these increases are encouraging, there still remains a large number of sexually active men and women who did not use condoms at last sex. Further, as has been pointed out earlier, condom use at last sex cannot serve as a proxy for consistent condom use and nothing is known about levels of condom use, nor the correct use over time from household data such as these.

3.2.4. Intimate partner violence

Findings from research in South Africa points to a “dual epidemic” of HIV and IPV in this country, largely as a consequence of strong patriarchal norms, and gender power inequities (Abdool Karim et al., 2010; Jewkes & Morell, 2010). Research has shown that women in South Africa who had experienced more than one episode of physical/sexual IPV were more likely to have HIV or acquire HIV (Dunkle, Jewkes, Brown, Gray, McIntyre & Harlow, 2004b; Jewkes et al., 2010). The elevated risk of HIV infection among these women is believed to be partly mediated by increased sexual risk taking among women who experience violence (Dunkle et al., 2004b), and partly as a result of violence which reinforces inequitable gender power distribution in relationships (Abdool Karim et al., 2010; Jewkes et al., 2010). It is in such relationships that women’s ability to use condoms and determine the timing and circumstances of sex are reduced (Jewkes et al., 2006a; Jewkes et al., 2010). It is also believed that the elevated risk may stem from men who are violent being at higher risk of having HIV (Dunkle et al., 2004a; Jewkes et al., 2006b). While there has been no research in a sample of men with a high enough HIV prevalence to be able to show an association between IPV perpetration and HIV sero-status, there is evidence that men who perpetrate physical and or sexual violence against their intimate female partners also engage in higher rates of HIV risk behaviours than non-perpetrators (Dunkle et al., 2006, Jewkes et al., 2006b; Hoffman, O’Sullivan, Harrison, Dolezal & Monroe-Wise, 2006; Simbayi, Kalichman, Jooste, Mathiti, Cain & Cherry, 2006), and are more likely to have a sexually transmitted infection (Simbayi et al., 2006). Despite the high prevalence of and the HIV-related risk that IPV poses for many people in South Africa, it is unfortunate that none of the national household surveys conducted to date in South Africa have explored this behaviour in the general population. This lack of general population-based evidence needs to be addressed, and an accumulation of subpopulation surveys that examine the prevalence of, and other HIV-related risks associated with IPV is one way in which to begin to address this significant gap.

3.2.5. Problem alcohol use

Eight of nine research studies conducted in South Africa included in a recent review, reported a strong link between alcohol use and HIV in this country (Kalichman et al., 2007). This is not unexpected given that South Africa also has one of the highest rates of alcohol

consumption in the world, estimated to be about 20 litres of pure alcohol per drinker per annum (Rehm et al., 2003). Recognising that heavy drinkers engage in behaviours that place them at considerable risk for HIV infection and transmission, high risk drinkers (defined as those who score 8 or more on the AUDIT questionnaire) have been classified as a most at risk population (MARPs) in the South African national household survey (Shisana et al., 2009). Compared to other MARPs identified in this survey, high-risk drinkers also reported the highest percentage of multiple partners (26.2% of high risk drinkers reported also having more than one sexual partner in the past 12 months) (Shisana et al., 2009).

3.3. Second generation HIV surveillance using RDS among HRH men in South Africa

The foregoing has argued that men between the ages of 25 and 55 years who have multiple, female sexual partners are a high-risk heterosexual (HRH) subpopulation in South Africa. Regular, biological and behavioural HIV surveillance among them using RDS is vitally important. First, to provide information about the existence and extent of concomitant HIV-related risk behaviours; second, to monitor behaviour and HIV prevalence over time (i.e., to “know your epidemic”) (UNAIDS, 2008a: p. 9); third, to develop targeted interventions in response; and finally to evaluate HIV interventions and thus provide an evidence-based indication of accountability, and more cost-effective use of resources. BBSS should include measures of the extent of multiple and concurrent sexual partnering, age-disparate sexual relationships, consistent condom use, intimate partner violence and alcohol misuse in the behavioural assessments. By so doing, trends in these high risk behaviours may be monitored over time providing invaluable evidence-based information for and evaluation of prevention efforts, including national HIV prevention programmes.

3.4. The reach and effect of national HIV prevention programmes in South Africa

South Africa has a range and multitude of HIV prevention programmes that incorporates a spectrum of school-, community- and national-level coverage. One hundred percent of schools in this country provided life skills based HIV education in 2008 and in 2009 (South African Government, 2010). A number of domestically and internationally funded non-government organizations (NGO's) provide small-scale and diverse prevention programmes at the community level and in the workplace (Kincaid, Parker, Schierhout, Connolly &

Chapter 1: Introduction and background

Pham, 2008; South African Government, 2010). There are four national, media-based communication programmes running in the country: Khomanani, Soul City, Soul Buddyz and Lovelife (Shisana et al., 2009). These programmes have combined annual budgets in excess of R300 million (approximately U.S.\$42.8 million). While these national programmes have different target audiences, they all carry appropriate HIV prevention information. Reach (defined as having seen or heard at least one component of the respective programmes) of these last four national programmes was assessed in the South African national household surveys. Aggregating data across all the programmes, reach across all age groups and genders of the general population had increased significantly between 2005 (74.0%; 95%CI: 71.9, 76.1) and 2008 (80.9%; 95% CI: 79.4, 82.3) (Shisana et al., 2009).

Supporting the extent of HIV prevention programmes in South Africa, Kincaid and colleagues (2008) conducted a national survey among 7006 adults aged between 15 and 65 years, and provide an analysis of the impact of 19 AIDS communication programmes in South Africa on 17 HIV and AIDS-related outcomes. These outcomes included condom use and efficacy; HIV testing; helping a person with AIDS who was sick; faithfulness, abstinence; multiple sexual partnering; and condom use with non-regular sexual partners. These researchers found that together the 19 programmes had reached 92.5% of the population; where reach was defined as having heard, seen or participated in each of the programmes in the past 12 months (Kincaid et al, 2008). The analysis demonstrated a pervasive and direct effect of exposure to these programmes on 13 of the 17 outcomes related to the AIDS epidemic in South Africa. Those outcomes not affected by programme exposure were abstinence, multiple sexual partnering and condom use with non-regular sexual partners (Kincaid et al., 2008).

Despite the reach of HIV- and AIDS-related programmes demonstrated by the above two sources, knowledge about sexual transmission of HIV and the ability to identify myths related to HIV decreased between 2005 and 2008 among the general South African population (from $\pm 40\%$ to 30%) (Shisana et al., 2009). Correct knowledge about sexual transmission of HIV among the MARP, black African men 25-49, decreased from 63.7% in 2005 to 43.8% in 2008 (Shisana et al., 2009). The major gap in knowledge had to do with the

risk of MCP and condom use with non-regular sexual partners (Kincaid et al., 2008). Not unexpectedly then, as has been pointed out previously, multiple sexual partnering and age disparate sexual relationships have increased (Shisana et al., 2009). These non-reinforcing findings between HIV programme reach and effects, and key HIV risk behaviours suggest that HIV programmes are most likely not providing the correct HIV prevention messages to the subpopulations who are most at risk, and who would benefit from and would provide benefit to others the most.

The point has been made repeatedly in the forgoing that HIV BBSS among high-risk subpopulations are vitally important for monitoring trends in HIV infection and HIV-related risk behaviours, and for an evaluation of HIV prevention programmes and other interventions among them. Such evidence-based surveys will also demand greater accountability from HIV funds recipients and more effective use of national and international resources for HIV prevention programmes. Evidence from a focus on South Africa confirms that BBSS among HRH men who have multiple sexual partners is necessary and timely if the country is to make any impact on the persistently high levels of HIV.

4. AIMS AND OBJECTIVES OF THE THESIS

The aim of this thesis is to develop an effective method of second generation HIV surveillance among heterosexual adult men residing in peri-urban, informal settings who have multiple, concurrent female sexual partners, and to examine HIV-related risk behaviours and HIV prevalence among them over time and across settings. Specific objectives are:

- i. To describe the prevalence of HIV and the extent of risk behaviours among HRH men, and their relationship to HIV serostatus and to each other.
- ii. To determine whether Respondent Driven Sampling (RDS) was an effective strategy for accessing HRH men who have multiple, concurrent sexual partners.
- iii. To explore whether there were any differences in risk behaviour among HRH men from the same subpopulation between 2006 and 2008.

- iv. To describe the relationship of HIV risk behaviours to intimate partner violence among HRH men.
- v. To describe the relationship of risky alcohol consumption to risk behaviours and HIV serostatus among HRH men.
- vi. To explore the dynamics in sexual relationships characterized by exchange.
- vii. To determine what gender-specific HIV prevention and risk reduction interventions have been implemented and evaluated among heterosexual adult males, in low- and middle-income countries.

5. METHODS

While each of the papers that form part of this thesis describe the respective studies' methodology (see Chapter 2), more detail is provided in the ensuing section. This section will provide a rationale for selecting the study settings in which BBSS were conducted; a description of formative research undertaken prior to the BBSS; and the way in which uniquely numbered recruitment coupons were used to recruit participants into the BBSS.

5.1. Study settings

Disaggregated Provincial data in South Africa shows that HIV prevalence in the Western Cape Province (3.8%) is the lowest of all 11 Provinces (Shisana et al., 2009). Although ANC sentinel site data from the Province are four times higher (16.1%) than in the general population in the Province, it is also the lowest of all the Provinces in the country (National Department of Health, 2008). However, there is substantial heterogeneity in HIV prevalence rates within the Province. For example, ANC HIV prevalence rates in one district is as low as 9.3%, while in another it is as high as 17.9% (National Department of Health, 2008). These differences suggest that there are subpopulations, communities and districts in the Western Cape that are at disproportionate risk of HIV.

While there are a number of peri-urban, informal settings that would fit the high risk demographic profile as outlined previously, Khayelitsha and Khayamandi were chosen in which to conduct BBSS. It is within these sites that the source population would be one in

which members engage in high-risk, HIV-related behaviours, and although large enough to have a meaningful influence on the spread of HIV, too small and diversely distributed in the general population to be captured in sufficient numbers.

5.1.1. Khayelitsha

Khayelitsha is a peri-urban community situated 20 kilometers South-east of Cape Town, South Africa in which 64% of dwellings have been identified as “informal dwelling/shack” (Statistics South Africa, 2001). Ninety-nine percent of the population of Khayelitsha consists of black African people. HIV prevalence among pregnant women in Khayelitsha in 2007 was 30.2% (Médecins Sans Frontières, 2008). Not only does Khayelitsha thus fit the high-risk demographic profile extracted from the national household survey data described previously, studies conducted in Khayelitsha have found that high risk sexual behaviours such as concurrent and age-disparate sexual partnering, and low condom use are fairly common.

Finding from a cross-sectional household survey conducted in Khayelitsha among residents found that 21% of men and 13% of women in marriage or regular sexual partnerships reported having at least one concurrent partnership in the last 12 months (Mah, 2008). In this same study, 19% of respondents reported that their partner/s had concurrent partners. Participants in a qualitative study in Khayelitsha indicated that concurrent sexual partnerships were common among both men and women (Mah & Maughan-Brown, 2009). These recent studies suggest that concurrent sexual partnering among residents in the community is characterized by the riskiest of Green et al’s MCP types: “regular partnerships, with one or both partners having regular concurrent partners when this pattern is common in the wider society” (Green et al. , 2009: p. 64).

A recent cross-sectional household survey conducted in Khayelitsha found that men reported that their current partner was on average 4.4 years younger than them (Boulle et al., 2007). In this same survey, men above 40 years of age reported partners seven years younger on average and women of all ages reported partners who were 5.1 years older on

average. Inconsistent condom use is widespread among people in Khayelitsha. Boulle et al.'s (2007) cross-sectional household survey found that 41% of men and 33% of women had used condoms at last sexual intercourse.

5.1.2. *Khayamandi*

Khayamandi is situated in the winelands of the Western Province on the outskirts of a large town, Stellenbosch, approximately 40 kilometers west of Cape Town, South Africa. Ninety-one percent of the population of Khayamandi consists of black African people. Almost 31% of dwellings are described as “informal dwelling” (Common Ground Holdings and Neville Naidoo and Associates, 2006). No published research findings related to concurrent and/or age-disparate sexual partnering and condom use exists for Khayamandi. However, its similarity to Khayelitsha in demographic, structural and in- and circular-migratory features points to the possibility that behaviours may exist among men and women in this community. The paucity of published research findings relating to HIV and sexual risk behaviour in this community was a further motivation for choosing this study setting for BBSS.

5.2. Formative research

All three BBSS in the above two settings were preceded by formative research comprising informal conversations with members of the target population. Research in similar settings in Cape Town and other parts of South Africa had identified shebeens and taverns as the places where men meet when seeking out new sexual partners (Weir et al., 2002; 2003). Thus, eight well-attended and geographically diverse shebeens were identified in each of the study sites. Male members of the project staff struck up general conversation with men in the shebeens. They identified themselves as working for the respective projects once rapport had been established in this way. The purpose of the conversations was to gather information pertinent to RDS recruitment and study logistics (Johnston, Whitehead, Simic-Lawson & Kendall, 2010). Study staff also took this opportunity to identify potential seeds. Where appropriate, adjustments to the study procedures were made to accommodate the information gleaned from these men. The study staff enquired about:

Chapter 1: Introduction and background

- Whether men who had multiple female sexual partners formed social “networks”: i.e. whether they were acquainted with one another, and whether they socialized with each other;
- Whether men would be willing to participate in a behavioural survey, and recruit their friends and acquaintances into the survey;
- The acceptability of providing anonymous, blood spots for HIV testing, perceptions of confidentiality;
- Whether the selected interview sites and hours of opening were appropriate and acceptable, and
- What form and value of incentives would be adequate and/or appropriate for participation and recruiting.

5.3. Recruitment coupons

Each seed and subsequent recruit who successfully participated in the BBSS was provided with three recruitment coupons with which to recruit their peers into the surveys. Each recruitment coupon was uniquely coded to link recruiters with recruits. The coupon consisted of two parts that could be easily separated along a perforation. One part of the coupon served as the “referral coupon”. The recruiter gave this part of the coupon to each of his recruits and only men who had a valid referral coupon were permitted to participate in the survey. The other part of the coupon served as the “payment coupon”. This part of the coupon was kept by the recruiter to claim an incentive for having recruited his peer/s into the survey. Both parts of the coupon had the same unique coupon identification number printed on them.

Coupons were numbered as follows: Using the example of seed number 01: once seed number 01 had participated in the BBSS, he would have been given three recruitment coupons numbered 01.1, 01.2 and 01.3. Taking the example of recruit number 01.2, once he had participated in the BBSS, he would have been given recruitment coupons numbered 01.2.1, 01.2.2, 01.2.3. Further, once recruit number 01.2.3. had participated in the BBSS for example, he would have been given recruitment coupons numbered 01.2.3.1, 01.2.3.2, and 01.2.3.3. In the above example, seed number 01 and recruits numbered 01.2 and 01.2.3 would

return to the study site at a later date and would be provided with a secondary incentive once project staff had established, via a coupon tracking logbook, that their recruits had indeed participated in the BBSS. This process of coupon numbering and issue permitted easy monitoring of waves of recruitment. The following figure provides a visual depiction of the way in which recruitment waves progress. The example in Figure 1 is for one seed only and demonstrates how 10 waves of recruitment produced 70 participants in one of the BBSS conducted in 2008. It also provides a visual display of recruitment patterns by HIV status, by marital status and by HIV X marital status. Note too that the final recruit's coupon number was X.1.2.1.1.1.3.3.2.1.1, where "X" represents the seed number and each digit thereafter, a wave of recruitment.

5.4. Ending RDS

As can be seen from Figure 1., not every participant used all recruitment coupons, and some participants did not recruit at all. This meant that large numbers of recruitment coupons were still in the possession of men who had not yet participated by the time the studies had reached their pre-determined sample sizes. The following procedures were followed to alert participants to closure of the study site. On-going monitoring of the number of participants and equilibrium on key variables enabled an estimation of the date for closure of the study. Every day over the two weeks prior to the estimated date for the termination of the study, a large poster explaining when the study would be terminated was posted at the entrance and other visible points at the study sites. On providing participants with their recruitment coupons, the study site manager reminded recruiters of the study closure date. The interview sites remained open for one week following study closure. Participants who presented to the study site for the first time (i.e., prospective participants) were told that the study had closed and recruiters who come to claim their secondary incentives were given the incentives.

6. ETHICAL CLEARANCE

The University of Cape Town Research Ethics Committee reviewed and approved the studies reported on in this thesis (REC REF 260/2006 and 193/2008). Because the 2008 BBSS reported in this thesis were baseline assessments for an HIV risk reduction intervention partly funded by the Western Cape Department of Health, ethical review and approval from this institution was also gained for the two 2008 BBSS. Thus all studies that comprise this thesis have appropriate ethical clearance.

Chapter 2: RESULTS IN THE FORM OF PUBLISHED PAPERS

Estimating HIV prevalence and risk behaviors among high-risk heterosexual men with multiple sex partners: use of respondent-driven sampling

Paper overview

This analysis used data from the BBSS conducted in Khayelitsha in 2006 and describes HIV prevalence and associated risk behaviours among the subpopulation of HRH men.

Contribution to the thesis and novelty

This paper describes and presents findings from the first known second generation HIV surveillance survey to be conducted among a HRH subpopulation. Prior to this survey, BBSS had only been conducted among populations most at risk (MARPs); namely men who have sex with men, commercial sex workers, and injecting drug users internationally. The paper addresses the first objective of this thesis: to describe the prevalence of HIV and the extent of risk behaviours among HRH men, and their relationship to HIV serostatus and to each other.

Contribution of candidate

The candidate was responsible for protocol development and ethics approval; development of the behavioural questionnaire; staff training, on-site project management, and data entry. The candidate was co-responsible for data analysis and in the writing of the first and all subsequent drafts of this paper, assisting with the integration of co-author and reviewer comments.

Publication status

Published in the *Journal of Acquired Immune Deficiency Syndromes* in 2009.

Estimating HIV Prevalence and Risk Behaviors Among High-Risk Heterosexual Men With Multiple Sex Partners: Use of Respondent-Driven Sampling

Mickey Chopra, MSc,* Loraine Townsend, MSc,* Lisa Johnston, PhD,† Cathy Mathews, PhD,*‡ Mark Tomlinson, PhD,*|| Heidi O'Bra, MPH,§ and Carl Kendall, PhD†

Objectives: To collect HIV data from high-risk men who have multiple, younger, female sex partners in a periurban township in South Africa.

Design: Unlinked anonymous cross-sectional survey using respondent-driven sampling.

Methods: Survey conducted among men aged 18 years or older who reported having had sex with more than 1 female partner in the previous 3 months (one of whom was either 3 or more years younger than the participant or below the age of 24) and lived in the area of recruitment.

Results: The median age of the 421 recruited men was 28 years (range: 18–62 years). They reported a median of 6 sexual partners (range: 2–39) during the past 3 months, and 51% (confidence interval: 45.0 to 59.6) reported inconsistent condom use with their casual partners. During the 3 months before the survey, 98% of men reported having concurrent sexual relationships. HIV prevalence was 12.3% (confidence interval: 8.3% to 16.9%). Being older than 24 years and not using a condom during the last sexual intercourse with a 1-time sexual partner were significantly associated with HIV infection.

Conclusions: This group of heterosexual urban men practice high levels of risky sexual behavior and are an important group that require more targeted HIV surveillance and prevention interventions.

Key Words: heterosexual men, HIV/AIDS, respondent-driven sampling, South Africa, surveillance

(*J Acquir Immune Defic Syndr* 2009;51:72–77)

INTRODUCTION

Southern Africa continues to be highly affected by the HIV epidemic with an adult population prevalence that is substantially higher than other parts of Africa and Asia.¹ Currently, the national HIV prevalence in South Africa is estimated to be 10.8% but with a great deal of subnational and gender variation. Higher aggregated prevalence rates are found for women between the age of 15 and 49 years (20.2%) compared with men of the same age (11.7%), for Africans (13.3%) compared with other racial groups (less than 2%), and for those who reside in urban informal localities (17.6%) compared with other locality types (around 10%).²

Distinct patterns of HIV distribution, along with close analysis of factors related to declines in HIV incidence in Uganda^{3–5} and Zimbabwe,⁶ strongly suggest that the sexual behaviors of men in their mid-20s and older residing in periurban settings are vital to understanding why HIV prevalence is so high. Infection rates are particularly high among young women under 24 years, and having an older male sexual partner is consistently found to be an HIV risk factor for younger women. High levels of concurrent sexual partners (ie, more than 1 overlapping sexual partner in the same period) among key groups of usually older men and younger women along with inconsistent condom use and low levels of male circumcision^{7,8} are being highlighted as critical factors driving the epidemic in the region.

The use of sexual networks⁹ to understand the spread of infectious diseases^{10,11} is also clarifying the specific context of the epidemic. For instance, a recent study that carefully mapped the sexual networks of heterosexual relationships on an island in Lake Malawi found that one fifth of the population was in mutually faithful relationships but that two thirds of the population could be linked by sexual relations over the last 3 years. These chains were held together by decentralized, robust, linkages of “ordinary” (ie, not sex workers, truck drivers, etc.) men and women in sexual networks marked by high levels of long-term concurrent partnerships.¹² Studies

Received for publication September 23, 2008; accepted December 12, 2008. From the *Health Systems Research Unit, Medical Research Council, Cape Town, South Africa; †Department of International Health and Development, Tulane University, School of Public Health and Tropical Medicine, Center for Global Health Equity, New Orleans, LA; ‡School of Public Health and Family Medicine, University of Cape Town, Rondebosch, South Africa; §HHS-Centers for Disease Control and Prevention/Global AIDS Program, Pretoria, South Africa; and ||Department of Psychology, University of Stellenbosch, South Africa.

Supported by fund from the Medical Research Council, South Africa, and the US Centers for Disease Control and Prevention/Global AIDS Program, Pretoria, South Africa.

Disclaimer: The findings and conclusions in this article are those of the authors and do not necessarily represent those of the Centers for Disease Control and Prevention.

Correspondence to: Prof Mickey Chopra, MSc, Health Systems Research Unit, Medical Research Council, Parow, 7505 Western Cape, South Africa (e-mail: mickey.chopra@mrc.ac.za).

Copyright © 2009 by Lippincott Williams & Wilkins

suggest that such networks are widespread across Southern Africa especially in periurban settings.^{13–15}

In response to the urgent need to monitor and understand high risk groups of men,¹⁶ it is necessary to have more information on male social and sexual networks in periurban settings. Traditional sampling methods such as those used at antenatal clinics and in households are either inappropriate or very inefficient in recruiting these men. Easy to use sampling methods, such as general snowball sampling, provide inaccurate estimates; more robust sampling methods, such as time–location sampling, are often logistically difficult to prepare and implement, and expensive to conduct.¹⁷ Respondent-driven sampling (RDS) is an approach that has been successfully used to sample specific high-risk groups such as injecting drug users,^{18,19} men who have sex with men,^{20,21} and sex workers.²² RDS, a chain referral sampling method, begins with a nonrandomly selected set of seeds (those who initiate the recruitment process) who, through the use of coupons, recruit members of their peer group with whom they share certain characteristics. The central features that distinguish RDS from snowball sampling are that all participants recruit only a set number of respondents thereby limiting their influence on the final sample composition, and that social network sizes of each participant are used to account for difference recruitment. A recent systematic review²³ reported 123 successful RDS studies conducted in countries outside of the United States, but it has never been used in a population of heterosexual men at high risk for sexual transmission of HIV.

The aim of this study was to use RDS to measure HIV prevalence and describe key characteristics among periurban heterosexual men engaging high HIV risk behaviors.

METHODS

Study Design

An HIV prevalence and sexual risk behaviors survey, using RDS,^{24,25} was conducted from September to December 2006 among a subset of sexually active males in a black African periurban settlement on the outskirts of Cape Town, South Africa (population: 330,000).²⁶ In this survey, eligible persons received a recruitment coupon from a peer, used it to enroll in the survey at a fixed location, completed an interview, provided a biological specimen for HIV testing, and received an incentive and a new set number of coupons with which to recruit their peers. Recruiters received another incentive for each person they recruited into the survey. This process continued for multiple rounds or waves, creating long chains of recruits until the sample size was reached.

Eligible males were 18 years and older, who reported more than 1 female sexual partner in the previous 3 months who was either more than 3 years younger than the participant or below the age of 24. Formative research was conducted prior to the survey, and the results used to nonrandomly select 8 males who fitted the eligibility criteria and who stated that they were able to recruit into the survey other similar males. The initial recruiters, and each participant who completed the survey, received up to 3 recruitment coupons with which to recruit other eligible males. The coupons provided a brief

description of the survey, the interview location address, and a phone number with which to make an appointment. The coupons also included a unique number that was used to track who recruited whom and to match the questionnaire and the biological specimens to the participant.

The sample size of 430 was calculated based on an estimated HIV prevalence of 25% among pregnant women in the geographic area²⁷ with a precision of $\pm 5\%$ and a design effect of 1.5.

Data Collection

Eligible participants received an explanation of the study process and provided written consent before being interviewed by a trained interviewer. Interviews consisted of questions about participants' current socioeconomic status, sexually transmitted infections history, current and past sexual risk behaviors with different types of sexual partners, and whether sex involved any payment of money or goods (food, cosmetics, clothes, transportation, items for children or family, school fees, or cash). Formative research identified the different categories of sexual partners as main partners, defined as steady partners or wives; casual partners, defined as regular partners (outside of steady partner or marital relationships); and 1-time partners, defined as partners with whom men had just a single sexual encounter. Concurrency was assumed if men reported a main sexual partner and casual or one-time partners in the same time period.

Participants were also asked the number of men they personally knew that they could recruit into the survey to estimate their network size. A dried blood spot was collected by a trained nurse according to standard operating procedures, and participants were offered free voluntary counseling and testing and HIV test results on site. Participants who completed the interview received a telephone voucher worth R60 (\pm US \$8), and participants who recruited other eligible participants received telephone vouchers valued at R20 (\pm US \$2.70) for each of up to 3 successful recruits. Successful recruits were required to present a coupon, fulfill eligibility criteria, and complete the survey. Ethical approval was granted by the University of Cape Town Ethics Committee.

Data Analysis

Estimates of proportions and 95% confidence intervals (CIs) were calculated using the Respondent-Driven Sampling Analysis Tool 5.6 (RDSAT) (www.respondentdrivensampling.org). This software package generates sample weights to take into account the variations in participants' network sizes (degree weight) and differential recruitment and homophily (recruitment weight).²⁸ In the univariate analyses, we estimated crude risk ratios of HIV status by all covariates separately. The dependent variable was weighted with population weights generated by RDSAT 5.6. All odds ratios and corresponding *P* values were calculated using STATA, version 9.0.

RESULTS

In total, 468 men presented coupons but 47 were ineligible providing a final sample of 421 men (excluding the

initial recruiters) and obtaining a maximum of 13 waves. The median age of the sample was 28.7 years (interquartile range 23.0–32.5 years), and the average network size was 5.64 (range 1–45). Most (94.7%) of the men were never married. Men in this survey were more highly educated and more likely to be employed than those of a similar age group in the last population census in 2001 conducted in the same area (Table 1). The men reported a range of 2–39 sexual partners in the 3 months before the survey with a mean of 6 and median of 5. The median number of sexual partners in the last 3 months classified as main, casual, and one off was 1, 3, and 1, respectively. During the 3 months before the survey, 98% of men had concurrent sexual relationships.

HIV prevalence was 12.3% (CI: 8.3 to 16.9). Being older than 24 years and not using a condom during the last sexual intercourse with a one-off sexual partner were significantly associated with HIV infection (Table 2). More than one third of men reported symptoms of a sexually transmitted infection in the 12 months before the survey.

Just under two thirds of men (64.0%; CI: 57.4 to 71.5) did not use a condom during last sexual intercourse with their steady partner. A lower proportion did not use a condom at last sex with their casual and one-time sexual partners (35.9%; CI: 29.8 to 44.1 and 42.4%; CI: 33.9 to 50.2, respectively).

Most men (83.3%, CI: 77.4 to 88.5) indicated that their friends would approve if they had sex with a woman who was not their steady partner or wife, and 86.1% (CI: 80.1, 90.5) indicated that their friends would approve if they changed girlfriends often.

More men reported that their casual partners and one-time partners were 5 or more years younger than they were (24.3%; CI: 17.6 to 31.6 and 25.2%; CI 17.1 to 32.4, respectively) compared with the number of men who reported that their main partners were 5 or more years younger than they were (9.2%; CI: 5.8 to 14.4). Participants were asked whether they thought their sexual partners had had sex with them because they expected or had received any form of material goods. Forty-six percent of respondents (CI: 38.0 to 54.3) thought this was so for their main partners; 82.8% (CI: 75.4 to 87.0) for their casual partners; and 90.6% (CI: 84.8 to 95.0) for their one-time partners.

TABLE 1. Comparison of Education and Employment Status Between the RDS and 2001 Census Data Among Men in a Periurban Settlement Outside Cape Town, South Africa, 2006

	2006 Survey Data, n = 421	2001 Census Data, n = 1,207,429
Education, %		
Grade 8–11	55.7	37.5
Grade 12	34.6	16.9
Unemployed*, %	17.2	30.4

Survey data: All participants unemployed at survey, excluding students.

*STATS 2001: All unemployed adults (20 years+) actively seeking work as a percentage of all adults available for work, excluding those not seeking work (homemakers, students, retired people).

Shebeens (local drinking bars) or taverns were most commonly cited as places where men met with friends for recreation (31.2% shebeens; CI: 25.0 to 38.6 and 54.4% taverns; CI: 46.5 to 59.6, respectively). Most men (81.8%; CI: 76.2 to 87.5) reported drinking more than 5 beers/ciders or tots of alcohol during these visits. Seventy-four percent (CI: 67.1 to 80.7) indicated that they had met a new sexual partner at either of these venues in the past 30 days.

DISCUSSION

This study has identified and conducted detailed surveillance among a group of heterosexual men who are engaging in extremely risky sexual behaviors in a high HIV transmission setting. Evidently, this group of single relatively well-off men pursuing multiple female partners and concurrent relationships are connected through social networks. They are better educated and more likely to be employed than the wider population of similar aged men residing in the same area. The HIV prevalence of 12.3% (CI: 8.3 to 16.9) among this study population is much higher than that found in general household surveys in the same region.²

The men in this sample reported a large number of sexual partners, most of whom were concurrent. Comparisons between low-level and high-level concurrency populations using mathematical modeling of HIV spread suggest that although the total number of sexual relationships can be similar in both populations, HIV transmission can be as much as 10 times greater in a high concurrency population.²⁹ Ethnographical and historical research suggest that the high cost of marriage has led men to remain single and, in turn, to show their social status through having multiple, concurrent sexual partners, and unprotected sex.³⁰ Most men in our survey also reported that male peers were supportive of behaviors associated with having multiple sexual partners. Peer opinion leader type interventions that aim to shift social norms and have led to decreases in HIV and associated risky behaviors in other populations^{31,32} may be appropriate for this population.³³

Our finding that more men reported being 5 or more years older than their casual or one-time partners than their main partners has not been reported elsewhere in the literature. In a recent South African national survey, about one third of female adolescents had partners who were at least 5 years older and significantly more likely to be infected with HIV.³⁴ Twenty-five percent of adolescents from a similar periurban community near Cape Town reported experiencing their sexual debut at an average age of 14.6 years, with someone who was 5 or more years older than them.³⁵ The men in the study reported low levels of condom use especially with their main sexual partners. These types of relationships may result in sexual power imbalances whereby young girls in relationships with older men are less likely than women in relationships with similarly aged men to negotiate safe sex practices.³⁶

Power imbalances in sexual relationships are also exacerbated by the common practice of giving some sort of material goods or cash to sexual partners. The majority of sexual acts, especially with nonregular partners, were accompanied by some sort of exchange of material goods according to our respondents. Also known as transactional

TABLE 2. Sociodemographic and HIV Risk Factors Associated With HIV Status Among Men in a Periurban Settlement Outside Cape Town, South Africa, 2006

	All No. (%)	HIV Positive (n = 59) No. (%)	HIV Negative (n = 350) No. (%)	OR (95% CI)
Age groups (n = 421)				
18–24	140 (37.1)	4 (6.2)	128 (39.3)	1.00
25–34	205 (45.0)	33 (56.0)	169 (45.4)	7.79 (2.33 to 26.06)*
≥35	76 (18.0)	22 (37.8)	53 (15.3)	16.48 (4.7 to 57.83)*
Education (n = 372)				
<8 years	29 (9.1)	6 (14.2)	23 (8.9)	1.00
8–12 years	343 (90.9)	46 (85.8)	287 (95.1)	0.63 (0.24 to 1.64)
Employment (n = 371)				
Unemployed	96 (26.5)	8 (15.6)	85 (27.7)	1.00
Part time	46 (13.8)	9 (19.2)	35 (12.8)	2.99 (0.99 to 8.98)
Full time	229 (59.7)	34 (65.1)	190 (59.5)	2.13 (0.90 to 5.04)
Marital status (n = 336)				
Never married	338 (94.7)	46 (94.6)	284 (92.2)	1.00
Currently/ever married	28 (5.3)	5 (5.4)	21 (5.0)	0.61 (0.22 to 1.72)
STI symptoms in past 12 months (n = 372)				
No	225 (62.9)	29 (65.8)	190 (62.5)	1.00
Yes	147 (37.1)	23 (34.2)	120 (37.5)	1.28 (0.69 to 2.35)
Total no. sexual partners (main, casual, one time) in past 3 months (n = 372)				
2–6	219 (66.6)	26 (10.7)	186 (89.3)	1.00
>6	153 (33.4)	26 (12.5)	124 (87.5)	1.36 (0.74 to 2.51)
Five or more years older than main partner (n = 345)				
No	308 (90.6)	43 (93.1)	256 (89.7)	1.00
Yes	37 (9.2)	7 (6.9)	30 (10.3)	1.25 (0.80 to 1.95)
Five or more years older than casual partner (n = 345)				
No	258 (75.7)	36 (78.2)	213 (74.4)	1.00
Yes	87 (24.3)	15 (21.8)	71 (25.6)	1.52 (0.79 to 2.91)
Five or more years older than 1-time partner (n = 293)				
No (referent)	206 (74.8)	26 (61.9)	175 (77.2)	1.00
Yes	87 (25.2)	15 (38.1)	70 (22.8)	1.41 (0.72 to 2.74)
Did not use a condom during last sex with main partner (n = 350)				
No	120 (36.0)	21 (53.5)	94 (31.5)	1.00
Yes	230 (64.0)	29 (46.5)	197 (68.5)	0.67 (0.35 to 1.25)
Did not use a condom during last sex with casual partner (n = 334)				
No	220 (64.1)	31 (65.9)	182 (63.5)	1.00
Yes	114 (35.9)	21 (34.1)	117 (36.5)	1.09 (0.59 to 2.02)
Did not use a condom during last sex with 1-time partner (n = 320)				
No	187 (57.6)	20 (28.5)	163 (61.9)	1.00
Yes	133 (42.4)	25 (71.5)	103 (38.1)	2.07 (1.07 to 3.99)*
Gave any material goods to main partner during recent sexual encounter (n = 340)				
No	197 (53.6)	33 (68.3)	158 (50.0)	1.00
Yes	143 (46.4)	17 (31.7)	125 (50.0)	0.68 (0.36 to 1.29)
Gave any material goods to casual partner during recent sexual encounter (n = 351)				
No	57 (17.2)	8 (14.1)	48 (17.4)	1.00
Yes	294 (82.8)	44 (85.9)	243 (82.6)	1.23 (0.52 to 2.93)
Gave any material goods to 1-time partner during recent sexual encounter (n = 321)				
No	28 (9.4)	4 (4.9)	24 (9.9)	1.00
Yes	293 (90.6)	42 (95.1)	244 (90.1)	1.40 (0.40 to 4.90)
Alcohol consumption (n = 347)				
No alcohol or <5 beers/ciders/tots (referent)	49 (18.2)	7 (16.2)	41 (29.9)	1.00
High (5 + beers/ciders/tots)	298 (81.8)	41 (70.1)	250 (83.8)	0.82 (0.34 to 1.98)

Missing data accounts for the different numbers of responses to each of the variables. Twelve participants do not have HIV status data because they did not consent to provide dried blood spot.

OR, odds ratio; STI, sexually transmitted infection.

* $P < 0.01$.

sex, this practice is linked to intimate partner violence and risk of HIV through low condom use, and among women, low relationship control, and forced sex.^{37,38} Our findings indicate that transactional sex was more common with casual and 1-time partners, who were also more likely to be 5 or more years younger than the men, compared with main partners.

These data also suggest that there was a widespread occurrence of dissortative mixing between the men and their female partners. Dissortative mixing describes situations where people with differential risks for HIV (eg, younger low-risk females and older high-risk males) form sexual partnerships that substantially increases the risk of infection in those populations with lower risk.¹¹ Mathematical modeling suggests that dissortative networks with highly active nodes (eg, sexually active heterosexual males who do not use condoms and have multiple sexual partners) are more easily disrupted than assortative (sexual mixing between people with similar HIV risk behaviors) networks. Interventions that dissuade people from entering into dissortative networks or that modify behavior of the core groups will reduce the spread of HIV.³⁹

Possible Limitations

The RDS methodology provides representative estimates of men with a particular set of characteristics based upon our eligibility criteria, and it is therefore difficult to estimate what proportion of the total population of men this group represents. However, the local drinking venues described by the men in our sample as the most common places for meeting each other and acquiring new sexual partners are numerous in the townships. A recent study of men who frequent taverns has found similar attitudes and behaviors as reported here, and it identified more than 380 shebeens and taverns in the same geographical area of approximately 200 km².⁴⁰ This would suggest that men with these characteristics and behaviors are widespread.

The age differences used to determine eligibility were reported by respondents. This required that they knew their sex partners' ages with some accuracy. There is also a possibility that partners' ages were deliberately reported inaccurately in order to gain entry into the study.

The analysis software (RDSAT) generated the sample weights taking into account the variations in participants' social network sizes (degree weight) and differential recruitment and homophily (recruitment weight). However, it may be the case that this still underestimates the CIs in the multivariate analysis.

CONCLUSIONS

Recent ethnographic work demonstrates the behaviors reported here are not limited to this specific setting of Cape Town but are widespread in many other periurban situations.^{41,42} We have identified and described an important group of men who are actively engaged in exploiting the intersection of cultural sexual role expectations, differences in socioeconomic status, and gender power differentials to engage in high HIV risk behaviors. This study highlights how this neglected group is fueling the epidemic and bridging

high-risk and low-risk populations. For this reason, UNAIDS/World Health Organization have strongly encouraged the development of surveillance systems for this type of population group.¹⁶ The use of the RDS approach has allowed us to establish an important baseline to describe this group's HIV risk behaviors and prevalence. The challenge is now to institutionalize such a survey as part of the broader HIV surveillance process and to mobilize resources and political will to impact behavioral changes in this group of men.

ACKNOWLEDGMENTS

M.C., L.T., C.K., and C.M. conceived and designed the study, L.T., C.M., and M.T. managed the fieldwork, M.C., L.T., L.J., C.M., and H.B. conducted the main analysis and M.C., L.T., and L.J. wrote the first draft of the article. All authors contributed to the final article. M.C. is the guarantor of the data and study.

REFERENCES

1. UNAIDS/WHO. *UNAIDS/WHO AIDS Update: December 2006*. Geneva, Switzerland: UNAIDS/WHO; 2006.
2. Rehle T, Shisana O, Pillay V, et al. *South African National HIV Prevalence, HIV Incidence, Behaviour and Communication Survey, 2005*. Cape Town, South Africa: HSRC; 2006.
3. Low-Beer D. HIV-1 incidence and prevalence trends in Uganda. *Lancet*. 2002;360:1788. Author reply 1788–1789.
4. Stoneburner RL, Low-Beer D. Sexual partner reductions explain human immunodeficiency virus declines in Uganda: comparative analyses of HIV and behavioural data in Uganda, Kenya, Malawi, and Zambia. *Int J Epidemiol*. 2004;33:624.
5. Stoneburner RL, Low-Beer D. Population-level HIV declines and behavioral risk avoidance in Uganda. *Science*. 2004;304:714–718.
6. Gregson S, Garnett GP, Nyamukapa CA, et al. HIV decline associated with behavior change in eastern Zimbabwe. *Science*. 2006;311:664–666.
7. Bailey RC, Moses S, Parker CB, et al. Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial. *Lancet*. 2007;369:643–656.
8. Gray RH, Kigozi G, Serwadda D, et al. Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *Lancet*. 2007;369:657–666.
9. Liljeros F, Edling CR, Nunes Amaral LA. Sexual networks: implications for the transmission of sexually transmitted infections. *Microbes Infect*. 2003;5:189–196.
10. Adimora AA, Schoenbach VJ. Social context, sexual networks, and racial disparities in rates of sexually transmitted infections. *J Infect Dis*. 2005;191(Suppl 1):S115–S122.
11. Doherty IA, Padian NS, Marlow C, et al. Determinants and consequences of sexual networks as they affect the spread of sexually transmitted infections. *J Infect Dis*. 2005;191(Suppl 1):S42–S54.
12. Kohler H, HELLERINGER S. The Structure of Sexual Networks and the Spread of HIV in Sub-Saharan Africa. *AIDS*. 2007;21:2323–2332.
13. HELLERINGER S, Kohler HP. Social networks, perceptions of risk, and changing attitudes towards HIV/AIDS: new evidence from a longitudinal study using fixed-effects analysis. *Popul Stud (Camb)*. 2005;59:265–282.
14. Leclerc-Madlala S. Infect one, infect all: Zulu youth response to the AIDS epidemic in South Africa. *Med Anthropol*. 1997;17:363–380.
15. Wood K, Jewkes R. Dangerous love: Reflections on violence among Xhosa township youth. In: Morrell R, ed. *Changing Men in South Africa*. Pietermaritzburg, south Africa: University of Natal Press; 2001.
16. UNAIDS/WHO. *Third Generation HIV Behavioural Surveillance*. Geneva, Switzerland: UNAIDS/WHO; 2005.
17. Kendall CK, Kerr LR, Gondim RC, et al. An Empirical comparison of respondent-driven sampling, time location sampling, and snowball sampling for behavioral surveillance in men who have sex with men, Fortaleza, Brazil. *AIDS Behav*. April 4, 2008 [pub ahead of print].

18. Abdul-Quader AS, Heckathorn DD, McKnight C, et al. Effectiveness of respondent-driven sampling for recruiting drug users in New York city: findings from a pilot study. *J Urban Health*. 2006;83:459–476.
19. Stormer A, Tun W, Guli L, et al. An analysis of respondent driven sampling with injection drug users (IDU) in Albania and the Russian Federation. *J Urban Health*. 2006;83(6 Suppl):i73–i82.
20. Ramirez-Valles J, Heckathorn DD, Vazquez R, et al. From networks to populations: the development and application of respondent-driven sampling among IDUs and Latino gay men. *AIDS Behav*. 2005;9:387–402.
21. Johnston LG, Khanam R, Reza M, et al. The Effectiveness of respondent driven sampling for recruiting males who have sex with males in Dhaka, Bangladesh. *AIDS Behav*. 2008;12:294–304.
22. Johnston LG, Sabin K, Hien MT, Huong PT. Assessment of Respondent Driven Sampling for recruiting female sex workers in two Vietnamese cities: Reaching the unseen sex worker. *J Urban Health*. 2006;83(Suppl 7):16–28.
23. Malekinejad M, Johnston LG, Kendall C, et al. Using respondent-driven sampling methodology for HIV biological and behavioral surveillance in International settings: a systematic review. *AIDS Behav*. 2008;12:S105–S130.
24. Heckathorn DD. Respondent-driven sampling: a new approach to the study of hidden populations. *Social Problems*. 1997;44(2):174–199.
25. Heckathorn DD, Broadhead RS, Sergeyev B. A methodology for reducing respondent duplication and impersonation in samples of hidden populations. *J Drug Issues*. 2001;31:543–564.
26. Statistics South Africa. *Census 2001: Results of National Census South Africa*. Cape Town, South Africa: Statistics South Africa;2005.
27. Shaikh N, Abdullah F, Lombard CJ, et al. Masking through averages—intraprovincial heterogeneity in HIV prevalence within the Western Cape. *S Afr Med J*. 2006;96:538–543.
28. Salganik MJ, Heckathorn DD. Sampling and estimation in hidden populations using respondent-driven sampling. *Sociol Methodol*. 2004;34:193–239.
29. Morris M, Kretzschmar M. Concurrent partnerships and the spread of HIV. *AIDS*. 1997;11:641–648.
30. Jewkes R, Dunkle K, Koss MP, et al. Rape perpetration by young, rural South African men: prevalence, patterns and risk factors. *Soc Sci Med*. 2006;63:2949–2961.
31. Kelly JA, Amirkhanian YA, Kabakchieva E, et al. Prevention of HIV and sexually transmitted diseases in high risk social networks of young Roma (Gypsy) men in Bulgaria: randomised controlled trial. *BMJ*. 2006;333:1098.
32. Kelly JA. Popular opinion leaders and HIV prevention peer education: resolving discrepant findings, and implications for the development of effective community programmes. *AIDS Care*. 2004;16:139–150.
33. Lewis JJ, Garnett GP, Mhlanga S, et al. Beer halls as a focus for HIV prevention activities in rural Zimbabwe. *Sex Transm Dis*. 2005;32:364–369.
34. Pettifor AE, Rees HV, Kleinschmidt I, et al. Young people's sexual health in South Africa: HIV prevalence and sexual behaviors from a nationally representative household survey. *AIDS*. 2005;19:1525–1534.
35. Jaspán HB, Berwick JR, Myer L, et al. Adolescent HIV prevalence, sexual risk, and willingness to participate in HIV vaccine trials. *J Adolesc Health*. 2006;39:642–648.
36. Pettifor AE, Measham DM, Rees HV, et al. Sexual power and HIV risk, South Africa. *Emerg Infect Dis*. 2004;10:1996–2004.
37. Dunkle KL, Jewkes R, Nduna M, et al. Transactional sex with casual and main partners among young South African men in the rural Eastern Cape: prevalence, predictors, and associations with gender-based violence. *Soc Sci Med*. 2007;65:1235–1248.
38. Dunkle KL, Jewkes RK, Brown HC, et al. Transactional sex among women in Soweto, South Africa: prevalence, risk factors and association with HIV infection. *Soc Sci Med*. 2004;59:1581–1592.
39. Doherty IA, Shiboski S, Ellen JM, et al. Sexual bridging socially and over time: a simulation model exploring the relative effects of mixing and concurrency on viral sexually transmitted infection transmission. *Sex Transm Dis*. 2006;33:368–373.
40. Weir SS, Pailman C, Mahlalela X, et al. From people to places: focusing AIDS prevention efforts where it matters most. *AIDS*. 2003;17:895–903.
41. Smith DJ. Modern marriage, men's extramarital sex, and HIV risk in southeastern Nigeria. *Am J Public Health*. 2007;97:997–1005.
42. Wardlow H. Men's extramarital sexuality in rural Papua New Guinea. *Am J Public Health*. 2007;97:1006–1014.

Effectiveness of respondent-driven sampling to recruit high risk heterosexual men who have multiple female sexual partners: Differences in HIV prevalence and sexual risk behaviors measured at two time points.

Paper overview

This analysis used data from the BBSS conducted in 2006 and 2008 in Khayelitsha. The findings document the feasibility of respondent-driven sampling for recruitment of HRH into second generation BBSS. It compares HIV prevalence and HIV-related risk behaviours between the two time points in this setting.

Contribution to the thesis and novelty

This paper addresses objectives two and three of this thesis: to determine whether Respondent Driven Sampling (RDS) was an effective strategy for accessing HRH men who have multiple, concurrent sexual partners; and to explore whether there were any differences in risk behaviour among HRH men from the same subpopulation between 2006 and 2008. The paper provides a strong rationale for continued second generation BBSS among the subpopulation of HRH men and the use of RDS to recruit men into the surveys. It is the first known, published paper to assess the feasibility of RDS to recruit HRH men into BBSS. The paper was the first to have been able to examine differences in HIV prevalence and reported HIV-related risk behaviours among a subpopulation of HRH men over time. It was also one of the few papers to be able to link changes in behaviour to broader HIV prevention efforts in the community and at a national level.

Contribution of candidate

The candidate was responsible for protocol development and ethics approval; refinement of the behavioural questionnaire; staff training; project supervision; data capturing and data analysis. The first and subsequent drafts of the paper were undertaken by the candidate incorporating co-author and reviewer comments.

Publication status

Published in *AIDS and Behavior* July 2010.

Effectiveness of Respondent-Driven Sampling to Recruit High Risk Heterosexual Men Who Have Multiple Female Sexual Partners: Differences in HIV Prevalence and Sexual Risk Behaviours Measured at Two Time Points

Loraine Townsend · Lisa G. Johnston ·
Alan J. Flisher · Catherine Mathews ·
Yanga Zembe

© Springer Science+Business Media, LLC 2010

Abstract Regular HIV bio-behavioural surveillance surveys (BBSS) among high risk heterosexual (HRH) men who have multiple female sexual partners is needed to monitor HIV prevalence and risk behaviour trends, and to improve the provision and assessment of HIV prevention strategies for this population. In 2006 and 2008 we used respondent-driven sampling to recruit HRH men and examine differences in HIV prevalence and risk behaviours between the two time points. In both surveys, the target population had little difficulty in recruiting others from their social networks that were able to sustain the chain-referral process. Key variables reached equilibrium within one to six recruitment waves and homophily indices showed neither tendencies to in-group nor out-group preferences. Between 2006 and 2008 there were significant

differences in condom use with main sexual partners; numbers of sexual partners; and alcohol consumption. Further BBSS among this population are needed before more reliable trends can be inferred.

Keywords South Africa · High risk heterosexual men · Multiple sexual partnerships · Respondent-driven sampling · HIV prevalence and risk behaviours

Introduction

The United States President's Emergency Plan for AIDS Relief (PEPFAR) and other international programmes use the term "most at risk populations" (MARPs) to refer to female sex workers, injecting drug users and men who have sex with men [1]. This classification is relevant for countries that have concentrated HIV epidemics, but overlooks the presence of other high risk sub-populations in countries that have generalized epidemics where HIV is spread predominantly through unprotected heterosexual intercourse. The recent South African national HIV prevalence, incidence, behaviour and communication survey (hereinafter referred to as the HSRC survey report) identified other sub-populations that have a higher than average HIV prevalence in South Africa and included them as MARPs [2]. Two such sub-populations are black African men between 25 and 49 years and all men older than 50 years [2].

One of the predominant high-risk behaviours among men in these age categories is multiple, concurrent sexual partnering [3–5] where one or more sexual relationships overlap in time [6]. Although the evidence is not incontrovertible [7], concurrency is thought to be one of the key drivers of the HIV pandemic in southern Africa [3–5, 8]. The occurrence of this high-risk behaviour among high-risk

The findings and conclusions in this paper are those of the authors and do not necessarily represent those of the Centers for Disease Control and Prevention.

L. Townsend (✉) · C. Mathews · Y. Zembe
Health Systems Research Unit, Medical Research Council,
P.O. Box 19070, Tygerberg, Cape Town 7505, South Africa
e-mail: loraine.townsend@mrc.ac.za

L. G. Johnston
Department of International Health and Development, Center
for Global Health Equity, Tulane University, School of Public
Health and Tropical Medicine, New Orleans, LA, USA

A. J. Flisher
Division of Child and Adolescent Psychiatry and Adolescent
Health Research Unit, University of Cape Town, Cape Town,
South Africa

C. Mathews
Department of Public Health and Family Medicine,
University of Cape Town, Cape Town, South Africa

heterosexual (HRH) men, i.e., Black African men between 25 and 49 years and all men older than 50 years, calls for focused research and preventive strategies among this sub-population in South Africa. Regular HIV bio-behavioural surveillance surveys (BBSS) among HRH men will provide a means to monitor their HIV prevalence and risk behaviour trends, and to improve the provision and assessment of HIV prevention strategies for this population. This is especially important given the recent global economic crisis and dwindling global and local government funding for HIV [9] that will most likely result in a prioritization of HIV treatment over prevention [10].

Although national household surveys and sentinel site surveillance systems are used to capture HIV-related data from representative members of the general population, there are challenges in obtaining representative samples of HRH men. Household surveys may not capture sufficient numbers of HRH men. Indeed, less than 10% of respondents in the 10,856 households interviewed in the HSRC survey reported having two or more sexual partners in the 12 months prior to the survey [2]. Furthermore, HRH male respondents in household settings may provide inaccurate reports of sexual partnerships due to perceived lack of confidentiality and privacy [11, 12]. Sentinel surveillance is designed to track infection in the general population and infection in sub-populations such as HRH men is not captured by this method [13, 14].

Other methods used to recruit hard-to-reach populations include snowball sampling and time location sampling (TLS) [15]. Neither of these methods provides a representative sample of HRH men due to the influence of the choice of initial recruiters in the case of snowball sampling, and missing some important venues where HRH men may be found in the case of TLS [15]. As an alternative, respondent driven sampling (RDS) combines a modified form of snowball sampling with a mathematical model that weights the sample in such a way as to counteract bias introduced by the non-random manner in which participants recruit each other [16–18].

RDS starts with a number of eligible initial contacts or “seeds”. After the seeds are interviewed, they are given a set number of coupons with which to recruit eligible male peers from their social network to participate in the survey. Once each seed’s recruits have participated in the survey, they in turn are given a set number of coupons with which to recruit peers from their social networks to participate. Seeds and recruits are provided an incentive to participate and additional incentives for each recruit who completes the survey. This recruitment process continues through a number of recruitment waves until the required sample size is reached. A recent review of 123 international studies concluded that RDS was an effective strategy to sample high-risk, hard-to-reach and socially networked populations [19].

In 2006 and 2008, RDS was used to recruit HRH men residing in a peri-urban community on the outskirts of Cape Town, South Africa into HIV BBSS. We use data from these surveys to address two aims: to assess the feasibility and effectiveness of RDS in recruiting HRH men into HIV BBSS and to examine differences in HIV prevalence, and health and HIV sexual risks measured at two time points among this population of HRH men.

Methods

Study Design and Setting

Two cross sectional HIV BBSS conducted in 2006 and 2008 used RDS [16–18] to recruit adult men who have multiple female sexual partners and reside in a peri-urban community in South Africa. The community is situated on the outskirts of Cape Town in the Western Cape Province. Unemployment is high and many people live in extreme poverty [2, 20]. In 2006, the antenatal HIV prevalence in this health district was 32.7% [21].

Study Population

The study population in 2006 consisted of men aged 18 years and older who had two or more female sexual partners in the 3 months prior to the survey, at least one of whom was three or more years younger than the participants or younger than 24 years of age [22]. In 2008 the study population consisted of men aged between 25 and 55 years who had two or more female sexual partners in the 3 months prior to the survey, one of whom was five or more years younger than participants. The age restriction for at least one younger female partner was based on research that describes the significant HIV risk for young women who have older male sexual partners resulting in mixing populations with different HIV prevalence levels [2, 23, 24].

Procedures

We implemented RDS using standard recruitment and analytical methods [25]. Seeds and recruits were administered a behavioural assessment questionnaire by trained field staff, provided a blood sample for HIV testing, received a cellular telephone voucher valued at R60 (\pm US \$8.50) for participation, and three recruitment coupons with which to recruit eligible peers into the study. Recruitment coupons had unique recruitment numbers that were used to link recruiters to their recruits. Eligible participants provided written informed consent before being interviewed. Dried blood spots (DBS) were collected and

sent to a referral laboratory for analysis. Seeds and recruits received an additional telephone voucher valued at R20 (\pm US \$2.85) for each recruit who successfully completed the survey. Ethical clearance for both surveys was obtained from the Research Ethics Committee, Faculty of Health Sciences, at the University of Cape Town.

Survey Instrument

The surveys consisted of questions about participants' demographics, current and past sexual risk behaviours, symptoms of sexually transmitted infections (STIs), and alcohol use. Prior to the BBSS, members of the study teams had informal conversations with men in the study community, including those who may have fit the studies' criteria. From these conversation three types of female sexual partners were identified: main (steady sexual partner or wife), casual (clandestine partners outside of the main relationship with whom men had sex with regularly), and one-time (with whom men had sex with just once and never again). These types of partners were mutually exclusive. In this paper "non-regular partner" refers to both casual and one-time partners. Symptoms of STI was measured by enquiring whether participants had experienced pain when urinating, discharge from their penis or sores on their "private parts" in the 3 months prior to the survey. For this paper "any symptoms of STI" refers to having experienced any one of these symptoms in the 3 months prior to the survey.

Biological Testing

DBS samples were sent to a referral laboratory for anonymous HIV testing where serum was eluted from samples and tested with a fourth generation HIV ELISA (Vironostika Uniform II plus 0). Initially reactive samples were re-tested with a third generation (antibody only) HIV ELISA (SD Bioline). Samples that were reactive in both assays were reported as positive. Discordant samples were tested by western blot (HIV1/2 Biorad).

Data Analysis

Using data from the two surveys, the number of recruitment waves required to reach equilibrium and network homophily indices on key variables were generated using RDSAT 6.0 [26]. Equilibrium is the point at which the sample distribution on key variables remains stable within 2% of the equilibrium distribution, even though more individuals enter into the sample [17, 18]. It is at this point that the sample composition becomes independent of the seeds thereby overcoming any bias that non-random selection of seeds may have introduced. The attainment of

equilibrium indicates that the final sample is not biased by the non-random selection of seeds. Therefore, numerous waves of recruits are required to reach equilibrium [27]. Network homophily provides an indication of recruitment between different networks [17, 18]. With a range between +1 (completely homophilous, i.e. exclusive preference for and recruitment from one's own group) and -1 (completely heterophilous, i.e. exclusive preference for and recruitment from outside of one's own group), homophily index values close to 0 suggest that social ties among recruits and recruiters cross networks, thereby overcoming biases that solely in- or out-group recruitment may have introduced. These two measures provide a means to assess the level of bias and therefore the representativeness of the sample.

In univariate analysis, we provide sample proportions for seeds and recruits separately. Differences between seeds and sample proportions were assessed by means of Chi-square analysis using STATA version 10.0 [28]. Sample proportions, and population proportion estimates with 95% confidence intervals (CI) were calculated using the open source RDS Analysis Tool 6.0 (RDSAT) (<http://www.respondentdrivensampling.org>). This software package generates sample weights to take into account the variations in participants' network sizes (degree weight), and a combination of differential recruitment effectiveness across groups and homophily (recruitment weight) [16]. In the first instance (degree weight) RDSAT-generated population estimates are weighted to compensate for over-sampling of participants who have larger average network sizes and who thus have more recruitment paths leading to them [16]. Network sizes are measured by asking all participants to recall how many peers they know and have seen in the past 3 months. In the second instance (recruitment weight), RDSAT-generated population estimates are weighted to overcome biases that may have been introduced by the non-random selection of seeds [16].

To compare HIV sexual risk behaviours between 2006 and 2008, we performed several multinomial logistic regression analyses. The outcome variables in these models were frequency of condom use with most recent main partner (model 1), frequency of condom use with most recent non-regular partner (model 2), number of sexual partners in the past 3 months (model 3), having had a one-time partner in the past 3 months (model 4) and alcohol consumption (model 5). All models were adjusted for age (given the different age-related inclusion criteria between 2006 and 2008) and occupation (given the significantly higher rate of employment in 2008 compared to 2006), and models 1 through 4 included alcohol consumption (given the significant decrease in heavy alcohol consumption between the time points). Relative risk ratios (RRR) provide the probability of each model's outcome occurring in

each study year. All models included RDSAT-generated weights for each outcome variable.

Results

Feasibility of RDS: Recruitment Chains and Waves

Table 1 presents information about recruitment, recruitment chains and waves. Each study was able to recruit close to the required number of participants within a short time: between 3 and 4 months. Opening the study site daily (Study 2) rather than on weekends only (Study 1) produced faster recruitment and fewer average numbers of daily recruits.

Study 1 (2006)

Twenty seeds were identified by study staff in 2006. Their mean age was 29.8 years and mean network size was 6.7. Of these, six did not recruit anyone and three recruited

fewer than four participants. During the 4-month recruitment period, 14 seeds (excluding the six non-productive seeds) recruited 401 participants, for a final sample size of 421, including seeds. The majority of recruitment chains ($n = 8$; 57%) began with the maximum number of coupons given, i.e. three. Three of the 14 recruitment chains had a length of more than 10 waves and produced 67.5% ($n = 284$ of 421) recruits. Seeds were more likely to have completed high school ($p = 0.034$) and to be married ($p = 0.008$) compared to recruits.

Study 2 (2008)

Nineteen seeds were identified by study staff in 2008. Their mean age was 31.6 years and mean network size 21.3. Of these, five did not recruit anyone and seven recruited fewer than four participants. During the 3-month recruitment period, 14 seeds (excluding the 5 non-productive seeds) recruited 404 participants for a final sample size of 423, including seeds. Approximately one-third of recruitment chains began with three branches (i.e., the maximum

Table 1 Seed characteristics and recruitment effort in two bio-behavioural surveillance surveys of high risk heterosexual men who have multiple female sexual partners sampled in 2006 and 2008

Study 1: 2006						Study 2: 2008					
Seed Id	Age	Network size	Number of recruits	Number of waves	Total number of recruits	Seed Id	Age	Network size	Number of recruits	Number of waves	Total number of recruits
1	24	4	1	1	1	1	33	4	1	2	3
2	41	10	1	1	1	2	29	100	1	1	1
3	20	9	2	3	5	3	42	3	1	4	7
4	29	5	2	3	3	4	—	3	1	1	3
5	23	6	2	6	17	5	36	25	1	1	1
6	30	6	2	4	10	6	26	3	2	12	66
7	30	6	3	7	39	7	38	11	2	4	12
8	20	9	3	4	14	8	27	25	2	1	3
9	37	10	3	11	108	9	36	3	2	2	3
10	33	6	3	4	9	10	—	3	3	13	171
11	39	15	3	4	12	11	28	80	3	1	3
12	25	6	3	4	6	12	25	5	3	20	107
13	34	5	3	12	115	13	28	3	3	4	10
14	32	4	3	11	61	14	39	10	3	3	14
Mean 29.8		Mean 6.7		401		Mean 30.6		Mean 21.3		404	
Study opening hours and days				9 a.m. to 4 p.m.: weekends only		Study opening times				3 p.m. to 6 p.m.: Tuesday to Friday 10 a.m. to 6 p.m.: weekends	
Time taken to complete study				15 weeks (30 days)		Time taken to complete study				12 weeks (72 days)	
Average weekly number of recruits				30 (range 8–47)		Average weekly number of recruits				45 (range 9–102)	
Average daily number of recruits				15 (range 0–32)		Average daily number of recruits				8 (range 0–31)	
Required vs. actual sample size				430/421		Required vs. actual sample size				430/423	

number of coupons) ($n = 5$: 35.7%). Three of the 14 recruitment chains had a length of more than 10 waves and produced 81.3% ($n = 344$ of 423) recruits. Seeds were more likely to have completed high school ($p = 0.019$) and to be married ($p = 0.006$) compared to recruits.

Effectiveness of RDS: Equilibrium and Homophily

Equilibrium on 11 key variables was reached between 2 and 6 waves of recruitment in 2006, and between 1 and 6 waves of recruitment in 2008 (Table 2), well below the maximum number of waves in each sample. In both study samples, indices of homophily did not exceed 0.256 indicating that there was little or moderate preference for in-group recruiting. With the exception of being married in 2006 and 2008, and having had a one-time partner in 2006, levels of social distance in recruitment patterns were largely non-existent (Table 2).

HIV Prevalence and Associated Sexual Risk Behaviours

Study 1 (2006)

Results from the 2006 study have been described previously [22]. In sum, the median age of the 421 recruited men was 28 years (range 18–62). They reported a median of six sexual partners (range 2–39) during the past 3 months and 51% (CI 45.0, 59.6) reported inconsistent condom use with their casual partners. During the 3 months prior to the survey 98% of men reported having concurrent sexual relationships. HIV prevalence was 12.3% (CI 8.3, 16.9%). Being older than 24 years, and not using a condom during the last sexual intercourse with a one-time sexual partner, were significantly associated with HIV infection.

Study 2 (2008)

The final sample consists of 423 men. Their median age was 27 years (range 25–53) and their mean network size was 16.3 (range 1–300). The majority of men (94.3%) were not married, 37.9% had completed high school, and half (50.7%) were unemployed (Table 2). Men reported a mean number of 4.7 partners in the prior 3 months (range 2–30) (median 4). When asked whether in the last 3 months they had been in a sexual relationship with a woman whilst still having a sexual relationship with another, 93.9% responded affirmatively. More than half of the men (55.9%) reported having one-time partners in the 3 months prior to the study. HIV prevalence was 15.2% (CI 10.3, 21.6). Being older than 29 years was significantly associated with HIV status.

Study 1 (2006) and Study 2 (2008): Comparing Findings between the Two Time Points

Although results from the 2006 study have been described in detail previously and summarised earlier [22], for ease of comparison of findings between the two time points, Table 2 reproduces these findings. In some instances, we provide results not previously reported, for example having at least one one-time partner in the past 3 months (67.2%; CI 61.4, 74.0); always (11.0%; CI 7.1, 16.0), sometimes or often (46.5%; CI 38.9, 52.7) and never (42.5%; CI 35.6, 50.4) using a condom with a most recent main partner in the past 3 months; always (49.4%; CI 40.9, 55.5), sometimes or often (18.4%; CI 13.9, 25.3) and never using a condom (32.2%; CI 26.4, 38.7) with a most recent non-regular partner in the past 3 months; and one or more symptoms of a STI in the previous 3 months (16%; CI 11.7, 21.1).

Table 2 shows that men in both studies were similar with regards to age, education levels, and marital status. However, significantly more men in 2008 were unemployed compared to those in 2006 (49.3%: CI 40.3, 56.5 vs. 26.5%: CI 20.8, 34.1). Study 1 results in Table 2 have not been previously reported.

Table 3 presents the five multinomial logistic regression models. Between 2006 and 2008, there was a significant difference in inconsistent condom use (i.e. sometimes/often and never in the past 3 months) with any most recent main partner (RRR 0.52; $p = 0.004$ and RRR 0.46; $p = 0.001$). Between the two time points there was a significant difference in the numbers of sexual partners in the 3 months prior to the survey (RRR 0.22: $p = 0.000$). Between the two time points, significantly more men did not report having a one-time partner in the previous 3 months (RRR 0.51; $p = 0.000$). Between 2006 and 2008 there was a significant difference in the numbers of men drinking five or more alcoholic drinks (RRR 0.34; $p = 0.000$).

Discussion

Feasibility and Effectiveness of RDS to Recruit HRH

Using RDS in 2006 and again in 2008 to recruit men from a population of HRH men in our study context was both effective and feasible. Assessing the feasibility of RDS to recruit HRH men in our study context, we draw upon four requirements that Heckathorn and Jeffri [29] suggest must be met for a population to be effectively sampled using RDS.

First, participants should be acquainted with one another well enough to know that they belong to the same target population. That we were able to reach within nine

Table 2 Sample sizes (*n*) and proportions of seeds and recruits, adjusted population proportions and 95% confidence intervals (CI), estimated number of waves to reach equilibrium and indices of homophily by demographic characteristics, HIV status and HIV health and behaviour risks among high risk heterosexual men who have multiple female sexual partners sampled in 2006 and in 2008

Variable	Study 1: 2006					Study 2: 2008				
	Sample proportions, <i>n</i> (%)		Population proportions <i>n</i> (%) 95% CI		Estimated number of waves to reach equilibrium	Sample proportions, <i>n</i> (%)		Population proportions <i>n</i> (%) 95% CI		Estimated number of waves to reach equilibrium
	Seeds	Recruits	Seeds	Recruits		Seeds	Recruits	Seeds	Recruits	
Age										
18–29	10 (50.0)	236 (58.6)	246 (60.8) 53.5, 67.2		6	8 (42.1)	264 (66.1)	275 (69.7) 61.7, 77.1	5	0.181
30–39	9 (45.0)	132 (33.6)	141 (30.4) 24.8, 36.8		5	8 (42.1)	95 (25.0)	104 (24.0) 17.2, 31.1	5	0.111
>39	1 (5.0)	32 (7.8)	33 (8.8) 5.2, 13.3		6	3 (15.8)	34 (8.9)	37 (6.3) 3.3, 10.1	6	0.256
Education										
<Grade 8	1 (5.9)	28 (7.8)	29 (9.1) 5.2, 13.5		4	1 (5.3)	29 (7.3)	30 (10.4) 5.6, 15.6	3	0.070
Grade 8–11	5 (29.4)	189 (53.5)	199 (55.5) 48.5, 63.0		4	4 (21.1)	209 (52.1)	213 (51.7) 44.1, 59.3	3	0.113
Grade 12	11 (64.7)	131 (38.7)*	144 (35.4) 28.3, 42.2		4	14 (73.6)	153 (40.6)*	166 (37.9) 30.7, 45.7	3	0.108
Employed										
No	1 (6.3)	95 (25.9)	96 (26.5) 20.8, 34.1		3	6 (33.3)	171 (45.7)	177 (49.3) 40.3, 56.5	2	0.133
Yes	16 (93.7)	259 (74.1)	275 (73.5) 65.9, 79.2		4	12 (66.7)	199 (54.3)	210 (50.7) 43.5, 59.7	2	0.002
Married										
Yes	4 (23.5)	24 (7.7)	28 (5.3) 2.5, 7.8		4	4 (21.1)	23 (6.5)	27 (5.7) 2.7, 9.3	2	–0.198
No	13 (76.5)	325 (92.3)**	338 (94.7) 92.2, 97.5		2	15 (78.9)	374 (93.5)**	388 (94.3) 90.7, 97.3	3	–0.003
Sexual partner numbers: past 3 months										
2–6	12 (75.0)	207 (58.9)	219 (66.6) 59.2, 71.9		3	17 (85.0)	338 (83.9)	355 (89.2) 84.7, 93.2	2	–0.054
>6	5 (25.0)	148 (41.1)	153 (33.4) 28.1, 40.8		3	3 (15.0)	65 (15.1)	68 (10.8) 6.8, 15.3	3	0.090
Had minimum of one, one-time partner: past 3 months										
No	5 (31.2)	90 (25.5)	95 (32.8) 26.0, 38.6		2	9 (47.4)	129 (33.2)	138 (44.1) 35.6, 51.7	3	–0.147
Yes	12 (68.8)	265 (74.5)	277 (67.2) 61.4, 74.0		2	10 (52.6)	269 (66.8)	278 (55.9) 48.3, 64.4	2	0.324
Condom use with most recent main partner: past 3 months										
Always	3 (12.5)	44 (13.3)	46 (11.0) 7.1, 16.0		3	6 (31.6)	87 (22.9)	92 (23.0) 16.8, 30.8	3	0.052
Sometimes/often	5 (31.2)	138 (41.3)	143 (46.5) 38.9, 52.7		3	6 (31.6)	162 (41.9)	168 (42.6) 35.4, 51.6	2	0.073
Never	9 (56.3)	148 (45.4)	157 (42.5) 35.6, 50.4		4	7 (36.8)	134 (35.2)	141 (34.4) 26.0, 40.3	3	–0.031
Condom use with most recent non-regular partner: past 3 months										
Always	12 (68.8)	157 (46.2)	169 (49.4) 40.9, 55.5		3	16 (63.2)	203 (51.4)	214 (51.9) 43.9, 60.1	3	0.111
Sometimes/often	2 (18.7)	118 (21.0)	120 (18.4) 13.9, 25.3		2	5 (26.3)	145 (36.1)	150 (34.7) 27.7, 42.2	2	0.094
Never	3 (12.5)	74 (32.8)	77 (32.2) 26.4, 38.7		3	2 (10.5)	50 (12.5)	52 (13.4) 8.3, 18.9	3	0.021

Table 2 continued

Study 1: 2006				Study 2: 2008								
Variable	Sample proportions, <i>n</i> (%)		Population proportions <i>n</i> (%) 95% CI	Estimated number of waves to reach equilibrium	Network homophily	Sample proportions, <i>n</i> (%)		Population proportions <i>n</i> (%) 95% CI	Estimated number of waves to reach equilibrium	Network homophily		
	Seeds	Recruits				Seeds	Recruits					
Had one or more symptoms of a STI: past 3 months												
Yes	1 (6.2)	59 (16.1)	60 (16.0)	11.7, 21.1	3	-0.122	3 (15.8)	76 (19.0)	79 (17.9)	12.4, 23.7	2	-0.105
No	16 (93.8)	296 (83.9)	312 (84.0)	78.9, 88.3	4	0.117	16 (84.2)	322 (81.0)	337 (82.1)	76.4, 87.6	1	-0.025
HIV status												
Uninfected	14 (73.7)	331 (85.6)	350 (87.7)	83.0, 91.7	4	0.085	11 (78.6)	320 (84.7)	331 (84.8)	78.4, 89.7	1	-0.002
Infected	6 (26.3)	53 (14.4)	59 (12.3)	8.3, 16.9	3	0.060	3 (21.4)	57 (15.3)	60 (15.2)	10.3, 21.6	1	-0.060
Alcohol consumption: most often/last occasion												
<5 or 0 drinks	3 (18.8)	71 (19.9)	74 (23.2)	17.3, 29.3	3	0.045	10 (52.6)	133 (34.4)	143 (42.8)	35.0, 50.2	2	-0.169
5+ drinks	14 (81.2)	285 (80.1)	298 (76.8)	70.7, 82.7	2	0.070	9 (47.4)	265 (65.6)	273 (57.2)	49.8, 65.0	2	0.239

* $p < 0.05$; ** $p < 0.01$

participants of the required sample sizes within 3 and 4 months suggests that men in our target population had little difficulty recruiting others from their social networks with whom they were well enough acquainted to know they were part of the same target population.

Second, networks should be dense enough to sustain a chain-referral process. The long referral chains (between 11 and 12 in 2006 and between 12 and 20 in 2008) indicate that our studies reached socio-metric depth within the networks we sampled. Furthermore, all variables reached equilibrium within one to six recruitment waves, well within the 11–20 waves attained. Thus any bias from the non-random selection of seeds was theoretically eliminated. Together these findings suggest that social networks among HRH men are dense enough to sustain RDS recruitment.

Third, the population should not be segmented to the extent that recruitment occurs only within certain subgroups of the population. A valid sampling of the population requires that recruitment occurs across subgroups. With the exception of being married (in 2008), all variables' homophily indices in both studies showed neither tendencies to in-group nor out-group preferences. Because the vast majority (94%) were not married in 2006 and 2008, exclusive recruitment of unmarried men by those who were married may have more to do with very few married men available for participation than a preference for out-group recruitment. Finally, participants should be provided with adequate means to motivate them to recruit their peers. In both studies cellular telephone vouchers identified to be an acceptable and adequate incentive during formative research, proved to motivate participation and recruitment.

Using RDS in our study setting also proved to be practicably feasible. In both studies a staff of six was able to ensure the successful participation of sufficient numbers of recruits. Opening the study site on weekends only in 2006 required only 30 days of recruitment compared to the 72 days required in 2008. While recruiting over fewer days may be less costly and in resource-constrained contexts more appealing, this should only be considered if study staff is able to cope adequately with large numbers of recruits on a daily basis.

We have shown that RDS is an effective and feasible strategy for recruiting HRH men into HIV BBSS and recommend it should be continued on a regular basis in the current study setting and also among other MARPs as defined by the HSRC survey report.

Differences in HIV Sexual Risk Behaviour between 2006 and 2008

We found a significant increase in condom use with main sexual partners between 2006 and 2008. This finding was also reported in the HSRC survey report where rates of

Table 3 Sample sizes (*n*), population proportions, 95% confidence intervals (CI), and multinomial logistic regression (RRR[^]) models showing associations between year of survey and HIV risk behaviour outcomes among high risk heterosexual men who have multiple female sexual partners sampled in 2006 and in 2008

2006			2008			Always vs. inconsistent RRR (95% CI)	Always vs. never RRR (95% CI)
Always <i>n</i> (%) 95% CI	Inconsistent <i>n</i> (%) 95% CI	Never <i>n</i> (%) 95% CI	Always <i>n</i> (%) 95% CI	Inconsistent <i>n</i> (%) 95% CI	Never <i>n</i> (%) 95% CI		
Model 1: condom use with most recent main partner past 3 months*							
46 (11.0)	143 (46.5)	157 (42.5)	92 (23.0)	168 (42.6)	141 (34.4)	0.52 (0.33, 0.81)	0.46 (0.29, 0.71)
7.1, 16.0	38.9, 52.7	35.6, 50.4	16.8,30.8	35.4, 51.6	26.0, 40.3	<i>p</i> = 0.004	<i>p</i> = 0.001
Model 2: condom use with most recent non-regular partner past 3 months*							
169 (49.4)	120 (18.4)	77 (32.2)	214 (51.9)	150 (34.7)	52 (13.4)	1.01 (0.71, 1.43)	0.70 (0.46, 1.06)
40.9,55.5	13.9,25.3	26.4, 38.7	43.9,60.1	27.7,42.2	8.3, 18.9	<i>p</i> = 0.963	<i>p</i> = 0.090
2006			2008			2–6 vs. >6 RRR (95% CI)	
2–6 <i>n</i> (%) 95% CI	>6 <i>n</i> (%) 95% CI		2–6 <i>n</i> (%) 95% CI	>6 <i>n</i> (%) 95% CI			
Model 3: number of sexual partners past 3 months*							
219 (66.6)	153 (33.4)		355 (89.2)	68 (10.8)		0.22 (0.15, 0.31)	
59.2,71.9	28.1, 40.8		84.7, 93.2	6.8, 15.3		<i>p</i> = 0.000	
2006			2008			0 vs. >0, 1-time partners RRR (95% CI)	
0, 1-time partners <i>n</i> (%) 95% CI	>0, 1-time partners <i>n</i> (%) 95% CI		0, 1-time partners <i>n</i> (%) 95% CI	>0, 1-time partners <i>n</i> (%) 95% CI			
Model 4: had a minimum of one, one-off partner past 3 months*							
95 (32.8)	277 (67.2)		138 (44.1)	278 (55.9)		0.51 (0.36, 0.72)	
26.0, 38.6	61.4, 74.0)		35.6, 51.7	48.3, 64.4		<i>p</i> = 0.000	
2006			2008			<5 vs. 5+ drinks RRR (95% CI)	
<5 drinks <i>n</i> (%) 95% CI	5+ drinks <i>n</i> (%) 95% CI		<5 drinks <i>n</i> (%) 95% CI	5+ drinks <i>n</i> (%) 95% CI			
Model 5: alcohol use most occasions (2006), last occasion (2008)**							
74 (23.2)	298 (76.8)		143 (42.8)	273 (57.2)		0.34 (0.25, 0.49)	
17.3, 29.3	70.7, 82.7		35.0, 50.2	49.8, 65.0		<i>p</i> = 0.000	

[^]RRR relative risk ratio

*Adjusted for age, employment status and alcohol consumption

**Adjusted for age and employment status

condom use at last sex, disaggregated by South African province, increased significantly among males aged 15 years and older (from 21.3% in 2002 to 22.5% in 2005 to 49.0% in 2008) in the Western Cape [2]. It may also be related to the massive scaling up of male condom distribution that occurred in the study location from mid-2005 during which 4.8 million male condoms in 2005, 10.2 million in 2006 and 12.0 million in 2007 were distributed [30]. Currently one million male condoms on average are being distributing monthly in the study location and, more importantly, in public places accessed by men [31]. Although increases in condom use were seen with main partners, this was not the case among non-regular partners,

indicating a need for more focused condom promotion interventions for casual and one-time partnerships.

We found a significant reduction in the number of sexual partners and particularly one-time partners among our study population in 2008 compared to 2006. This finding corresponds to that reported in the HSRC survey report which found a significant reduction in the numbers of Western Cape residents aged between 15 and 49 years reporting more than one sexual partner in the previous year: from 11.3% in 2005 to 9.9% in 2008 [2].

We also found a decrease in alcohol consumption between 2006 and 2008. In an attempt to explain this decrease, during September 2009 members of the study

team conducted informal conversations with seven owners of alcohol outlets in the study location, over a period of 2 weeks. They asked about monthly turnover, customer numbers, and patterns of alcohol consumption between 2006 and 2008. Four owners who sell more expensive brands of alcohol reported a steady decrease in revenues and a decrease in customer numbers since 2006. On the other hand, three owners of smaller establishments who sell cheaper brands of alcohol reported increases in revenues and customer numbers since 2006. The results from our two HIV BBSS suggest that people may be drinking less. However, in light of the apparent increases in consumption of cheaper brands, this decline in consumption may not be sustained in future.

When taking the reduction in risk behaviours together, another explanation is possible. According to the HSRC survey report, communication reach among males aged 25–49 years increased significantly between 2005 and 2008; from 77.8% having heard or seen at least one component of any of four large-scale national HIV and AIDS programmes in 2005 to 83.6% in 2008 [2]. Increasing awareness of the behaviours that increase one's risk of HIV might be having the desired effect, including reducing the prevalence of such behaviours.

Limitations

These studies have a number of limitations. First, the RDS methodology provides representative estimates of people with a particular set of characteristics based upon specific eligibility criteria, and it is therefore, difficult to estimate what proportion of the total population this group of men represent. Second, the sampling weights used in the analysis are dependent on the degree to which men would have knowledge of their peers' sexual behaviours. Although the validity of this assumption is unknown, qualitative interviews with some of the men found that they socialised in close-knit friendship groups [32]. In these circumstances it is likely that the sexual behaviour of their friends may well have been known. Third, it is impossible to get a measure of reporting bias. Given that our interviewers were all male, men may have felt compelled to over-report behaviours perceived to be admired by fellow men. However, all interviewers were carefully selected and provided training to elicit honest and accurate recall, and to conduct interviews in a non-judgemental manner. Fourth, the different age restrictions on female partners in the two samples may have resulted in some potential recruits being excluded from the 2008 study. As the restriction was limited to only one of the female partners and the majority of men in both samples reported between two and six partners in the previous 3 months, it is unlikely that a significant number

of men would have been excluded for this reason. Finally, despite not being able to link the responses of men who participated in 2006 and 2008, in hindsight it would have been useful to have had a measure of repeat participation among the 2008 men. Future BBSS among this population of HRH men will enquire about having participated in previous BBSS.

In conclusion while RDS was clearly effective in successfully recruiting HRH men into two repeated cross-sectional BBSS over two time points, it should be stressed that inferences about behaviour change can only be made from longitudinal studies that have repeated measures for the same participants over time. The differences in sexual behaviour among the men in our two samples merely suggest that (positive) changes may be occurring. While encouraging, we recommend that more rounds of BBSS be conducted among the same population in this setting, or that longitudinal cohort studies be conducted before we can infer more reliable trends in behaviour change.

Acknowledgments Funding was provided by the Medical Research Council, South Africa, the Western Cape Department of Health, Cape Town, South Africa and the U.S. Centers for Disease Control and Prevention/Global AIDS Program, Pretoria, South Africa.

References

1. USAID. Request for proposals (RFP) no: 674-09-71 HIV/AIDS sexual prevention program. Pretoria: USAID Southern Africa; 2009.
2. Shisana O, Rehle T, Simbayi, LC, Zuma K, Jooste S, Pillay-Van Wyk V, et al. South African national HIV prevalence, incidence, behaviour and communication survey, 2008: a turning tide among teenagers? Cape Town: HSRC Press; 2009.
3. Halperin DT, Epstein H. Concurrent sexual partnerships help to explain Africa's high HIV prevalence: implications for prevention. *Lancet*. 2004;364:3–6.
4. Mah TL, Halperin DT. Concurrent sexual partnerships and the HIV epidemics in Africa: evidence to move forward. *AIDS Behav* [serial online]; 2008. <http://www.springerlink.com/content/aq8244262614q762/>. Accessed 3 Oct 2009.
5. Shelton JD. Ten myths and one truth about generalised HIV epidemics. *Lancet*. 2007;370:1809–11.
6. Parker W, Makhubele B, Nlabati P, Connolly C. Concurrent sexual partnerships amongst young adults in South Africa, challenges for HIV prevention communication [e-report]. Grahamstown: CADRE; 2007. <http://www.cadre.org.za/node/140>. Accessed 20 Oct 2009.
7. Lurie MN, Rosenthal S. Concurrent partnerships as a driver of the HIV epidemic in sub-Saharan Africa? The evidence is limited. *AIDS Behav*. 2010;14(1):17–24.
8. Soul City. Multiple and concurrent sexual partnerships in Southern Africa: a ten country research report. Johannesburg: Soul City; 2008.
9. Izazola-Licea JA, Wiegmann J, Arán C, Guthrie T, De Lay P, Avila-Figueroa C. Financing the response to HIV in low-income and middle-income countries. *J Acquir Immune Defic Sindr*. 2009;52:S119–26.
10. UNAIDS and Worldbank. The global economic crisis and HIV prevention and treatment programmes: vulnerabilities and impact. Geneva: UNAIDS and Worldbank; 2009.

11. Weir SS, Tate JE, Zhusupov B, Boerma JT. Where the action is: monitoring local trends in sexual behaviour. *Sex Transm Infect.* 2004;80(Suppl II):ii63–8.
12. Gregson S, Zhuwau T, Ndlovu J, Nyamukapa CA. Methods to reduce social desirability bias in sex surveys in low-development settings. *Sex Transm Infect.* 2002;29:568–75.
13. UNAIDS. AIDS epidemic update. Geneva: UNAIDS; 2008.
14. UNAIDS. Guidelines for second generation HIV surveillance. Geneva: UNAIDS/WHO; 2000.
15. Kendall C, Kerr LRFS, Gondim RC, Werneck GL, Macena RHM, Pontes MK, et al. An empirical comparison of respondent-driven sampling, time location sampling, and snowball sampling for behavioral surveillance in men who have sex with men, Fortaleza, Brazil. *AIDS Behav.* 2008;12:S97–104.
16. Heckathorn DD. Extensions of respondent-driven sampling: analyzing continuous variables and controlling for differential recruitment. *Sociol Methodol.* 2007;37:151–207.
17. Heckathorn D. Respondent driven sampling: a new approach to the study of hidden populations. *Soc Probl.* 1997;44:174–99.
18. Heckathorn D. Respondent driven sampling II: deriving valid population estimates from chain-referral samples of hidden populations. *Soc Probl.* 2002;49:11–34.
19. Malekinejad M, Johnston LG, Kendall C, Kerr LRFS, Rifkin MR, Rutherford GW. Using respondent-driven sampling methodology for HIV biological and behavioral surveillance in international settings: a systematic review. *AIDS Behav.* 2008;12:S105–30.
20. The Population Register Update: Khayelitsha. Pretoria: Department of Social Services and Poverty Alleviation; 2006.
21. Department of Health. 2008 National antenatal sentinel HIV and syphilis prevalence survey [e-report]. Pretoria: National Department of Health; 2008. <http://www.doh.gov.za/docs/reports-f.html>. Accessed 2 Feb 2010.
22. Chopra M, Townsend L, Johnston L, Mathews C, Tomlinson M, O’Bra H, et al. Estimating HIV prevalence and risk behaviors among high-risk heterosexual men with multiple sex partners: use of respondent-driven sampling. *J Acquir Immune Defic Syndr.* 2009;51:72–7.
23. Dunkle KL, Jewkes R, Nduna M, Jama M, Levin J, Sikweyiya Y, et al. Transactional sex with casual and main partners among young South African men in the rural Eastern Cape: prevalence, predictors, and associations with gender-based violence. *Soc Sci Med.* 2005;65:1235–48.
24. Luke N. Age and economic asymmetries in the sexual relationships of adolescent girls in sub-Saharan Africa. *Stud Fam Plann.* 2003;34:67–86.
25. Johnston LG. Conducting respondent driven sampling (RDS) studies in diverse settings: a training manual for planning RDS studies [e-manual]. Arlington: Centers for Disease Control and Prevention (GA) and Family Health International; 2007. <http://globalhealthsciences.ucsf.edu/PPHG/assets/docs/respondent-driven-sampling-2008.pdf>. Accessed 15 Dec 2009.
26. Volz E, Wejnert C, Degani I, Heckathorn DD. Respondent-driven sampling analysis tool (RDSAT) Version 5.6. Ithaca: Cornell University; 2007.
27. Salganik MJ. Variance estimation, design effects, and sample size calculations for respondent-driven sampling. *J Urban Health.* 2006;83(Suppl 1):98–112.
28. StataCorp. Stata statistical software: release 10. College Station: StataCorp LP; 2007.
29. Heckathorn DD, Jeffri J. Assessing the feasibility of respondent-driven sampling: aging artists in New York City [e-report]. 2005. http://arts.tc.columbia.edu/rcac/images/rcacimages/FeasRep_12.pdf. Accessed 18 Nov 2009.
30. Azavedo V. Scaling up male condom distribution in Cape Town Metro region [e-poster]. Cape Town: City of Cape Town. n.d. www.capetown.gov.za/en/.../Condom%20Distribution%20Poster.pdf. Accessed 20 Oct 2009.
31. Medicins Sans Fronetieres, Western Cape Department of Health, City of Cape Town Department of Health & University of Cape Town Infectious Diseases Epidemiology Unit. Comprehensive TB/HIV services at primary health care level: Khayelitsha annual activity report 2007–2008 [e-report]. Cape Town: Authors; 2008. www.msf.org.za/.../Khayelitsha/2007-2008_Annual_Activity_Report-August_2008.pdf. Accessed 20 Oct 2009.
32. Ragnarsson A, Townsend L, Thorson A, Chopra M, Ekström AM. Social networks and concurrent sexual relationships—a qualitative study among men in an urban South African community. *AIDS Care.* 2009;21(10):1253–8.

HIV risk behaviours and their relationship to intimate partner violence (IPV) among men who have multiple female sexual partners in Cape Town, South Africa

Paper overview

This analysis used data from the BBSS conducted in Khayamandi in 2008. The findings provide an explanation of the relationship between intimate partner violence and HIV risk behaviours among this study's sample.

Contribution to the thesis and novelty

This paper addresses the fourth objective of the thesis: to describe the relationship of HIV risk behaviours to intimate partner violence among HRH men. It is the first known published paper addressing the association of IPV to HIV risk behaviours among a subsample of men who are already at high risk of HIV, namely those who have multiple female sexual partners. Whereas a substantial body of literature examines women's experiences of IPV as victims, this paper is one of the few papers to examine levels of IPV perpetration and related HIV-risks reported by men. Recommendations for HIV risk reduction intervention/s, focusing on IPV and targeting this high risk subpopulation followed from the results of the analysis of this paper's data.

Contribution of candidate

The candidate was responsible for protocol development and ethics approval; refinement of the behavioural questionnaire; staff training; project supervision; data capturing and analysis. The first and subsequent drafts of the paper were undertaken by the candidate incorporating co-author and reviewer comments.

Publication status

Published in *AIDS & Behavior* in 2010.

HIV Risk Behaviours and their Relationship to Intimate Partner Violence (IPV) Among Men Who Have Multiple Female Sexual Partners in Cape Town, South Africa

Loraine Townsend · Rachel Jewkes ·
Catherine Mathews · Lisa Grazina Johnston ·
Alan J. Flisher · Yanga Zembe · Mickey Chopra

© Springer Science+Business Media, LLC 2010

Abstract HIV/AIDS and intimate partner violence (IPV) are growing public health concerns in South Africa. Knowledge about adult men's perpetration of IPV and links between HIV risk behaviours and IPV is limited. Respondent driven sampling was used to recruit men who have multiple concurrent female sexual partners. Forty-one percent of the 428 recruited men had perpetrated IPV. Inconsistent condom use was associated with physical IPV; experiencing a symptom of a sexually transmitted infection and engaging in transactional sex were associated with physical and sexual IPV; problem alcohol use was associated with physical, and any IPV, but not sexual IPV; having five or more partners was associated with sexual IPV; perceptions of partners' infidelity were associated

with physical and any IPV. HIV risk reduction interventions among men, especially those with multiple female sex partners, should incorporate strategies to change the underlying construction of masculinity that combines the anti-social and risky behaviours of IPV perpetration, inconsistent condom use, transactional sex and heavy alcohol consumption.

Keywords Concurrent sexual partnerships · HIV prevention · High risk heterosexual men · Intimate partner violence · Respondent driven sampling · South Africa

Introduction

The recent South African national household survey conducted in 2008 identified black African men in South Africa aged 25–49 years as a most-at-risk population (MARPs) [1]. MARPs engage in behaviours that put them at higher risk for HIV and usually have a higher than average HIV prevalence compared to people in the general population [2]. The South African national household survey found that black African men in this age category have the second highest HIV prevalence in the country (23.7%), surpassed only by the rate found among women aged 20–34 years (32.7%) [1].

In addition to the high prevalence of HIV in South Africa, intimate partner violence (IPV) is a growing public health concern that has serious implications for victims' mental and physical wellbeing [3, 4]. Physical and/or sexual violence perpetrated against women by their intimate male partners is a common experience worldwide [5]. In South Africa, much of the research on IPV has examined women's experiences as victims [6–9]. Lifetime reports of

L. Townsend (✉) · C. Mathews · Y. Zembe
Health Systems Research Unit, Medical Research Council,
P.O. Box 19070, Tygerberg 7505, Cape Town, South Africa
e-mail: loraine.townsend@mrc.ac.za

R. Jewkes
Gender and Health Research Unit, Medical Research Council,
Pretoria, South Africa

C. Mathews
School of Public Health and Family Medicine,
University of Cape Town, Cape Town, South Africa

L. G. Johnston
School of Public Health and Tropical Medicine,
Tulane University, New Orleans, LA, USA

A. J. Flisher
Division of Child and Adolescent Psychiatry and Adolescent
Health Research Unit, University of Cape Town,
Cape Town, South Africa

M. Chopra
United Nations Children's Fund, New York, NY, USA

physical or sexual violence reported by women in South Africa range from 43.3% among young rural women [8], to 55.5% among women attending antenatal clinics [6]. In the latter study, 30.1% of pregnant women had been assaulted in the past year and those who had experienced more than one episode of physical/sexual IPV were 54% more likely to have HIV than those who had not experienced a similar level of IPV [6].

Knowledge about adult men's perpetration of IPV and links between HIV risk behaviours and IPV among males in South Africa is limited. Research with a random sample of men aged 18–49 years in South Africa found that 42.4% had perpetrated physical or sexual IPV in their lifetime [10], and those perpetrating more than one episode of physical or sexual IPV were 48% more likely to have HIV than those who had not perpetrated IPV [11]. Similarly among working class men in Cape Town, 15.3% of men had perpetrated sexual violence [12] and 42.3% had perpetrated physical violence in the 10 years prior to the survey [13], and 8.8% had perpetrated physical violence in the 12 months prior to the survey [13].

The perpetration of IPV by men is believed to be a consequence of, and to sustain, inequitable gender power distribution that stems from ideologies of male superiority [14]. Within violent relationships women's ability to use or suggest using condoms, and determine the timing and circumstances of sex is reduced [8]. Further, in sexual relationships characterised by the exchange of cash or other material goods, the 'paying partner' (most often men) gains sexual leverage and the right to guard and use his 'investment' in the manner he chooses, including unprotected sex and the use of violence [15–18]. Additionally, men who perpetrate physical and/or sexual violence against their intimate female partners have been found to engage in higher rates of behaviours that increase their HIV risk [17]. These behaviours include having multiple sexual partners [11–13, 19, 20], inconsistent condom use [20], problem alcohol consumption [11–13, 19, 21], and engaging in transactional sex (TS) [11, 19, 20]. Research in South Africa among sexually transmitted infection (STI) clinic clients indicates that men who had a history of sexually assaulting women were more likely to have a history of genital ulcers [20], and women who had experienced sexual assault were more likely to have a STI [9], which in turn significantly increases the risk of HIV infection and transmission [3, 22].

Findings from the South African national survey referred to above also found significant increases in the percentages of black African men aged 25–49 years reporting multiple sexual partnerships that includes the likelihood of concurrent partnerships over time (from 7.0% in 2002, when the first national household survey was conducted to 17.4% in 2008) [1, 23]. Concurrent sexual partnerships,

where two or more partnerships occur in the same period of time, or where one partnership begins before another ends [24], are a widely accepted contributor to the HIV epidemic and are normative in sub-Saharan Africa [24–28]. There are sub-groups of men who practice unprotected sex with large numbers of, often younger, concurrent partners. They are perceived to be at particularly high risk of being infected with, and transmitting HIV [26, 27].

Black African men aged 25–49 years who have multiple female sexual partners are a sub-group of high risk heterosexual men (HRH) who compose a highly efficient network of HIV transmission; however, there is no reliable documented information describing their HIV related risk behaviours. One of the challenges to acquiring reliable data about this population is the difficulty accessing them in a representative sample. In household surveys male respondents are likely to under- or not report having multiple partners should they complete the survey in the presence of other family members. Furthermore, household surveys, unless very large, may not capture a sufficient number of HRH men from which to draw conclusions about them. Snowball sampling and time location sampling (TLS) have been successful in capturing difficult to access populations [29], but they either do not provide representative samples or are not appropriate for sampling HRH men. The former is biased by the choice of initial recruiters and the latter by the danger of missing some venues where HRH men may be found [29]. Another sampling method that has been successful in capturing difficult to access populations is Respondent Driven Sampling (RDS) [30]. This method combines a modified form of snowball sampling with a mathematical model that weights the sample in such a way as to counteract bias introduced by the non-random way in which participants recruit each other [30]. A recent review of 123 studies conducted internationally concluded that RDS was an effective strategy to sample high-risk, hard to reach and socially networked populations for HIV biological and behavioural surveillance [31].

The foregoing demonstrates that HIV risk behaviours are interwoven with multiple sexual partnering as well as IPV. This paper therefore describes the prevalence of physical and sexual IPV, and the association between HIV risk behaviours and IPV among HRH men recruited through RDS in a peri-urban setting on the outskirts of Cape Town. We hypothesised that past year perpetration of three IPV outcomes—physical, sexual, and physical or sexual IPV—would be higher among men who have multiple female sexual partners compared to that reported by other populations from the general population. We also hypothesised that past year perpetration of IPV would be associated with a range of HIV risk behaviours such as inconsistent condom use, having a STI, engaging in transactional sex, excessive alcohol consumption, having

large numbers of female sexual partners, and unfaithfulness among the female partners of HRH.

Method

Survey Design

From June to September 2008 we used RDS [32, 33] to recruit men into an HIV biological and behavioural surveillance survey. RDS starts with a pre-determined number of initial contacts or “seeds” who are eligible for the study. After the seeds are interviewed, they become recruiters and are given a set number of coupons to use for inviting eligible male peers from their social network to participate in the survey. Once each seed’s recruits have participated in the survey, they in turn are given a set number of coupons with which to invite peers from their social networks to participate. Seeds and recruits are provided an incentive to participate and for each recruit who enrolls in and who completes the survey. This recruitment process continues through a number of recruitment waves until the required sample size is reached.

Eligibility and Survey Setting

Eligible men were those who reported having two or more female sexual partners in the 3 months prior to the study. Eligible men were living in a peri-urban community 50 km north-east of Cape Town, South Africa; were 25–55 years of age; had sex with two or more female partners in the 3 months prior to the study, one of whom was five or more years younger than the participant. The age restriction for female partners was based on research that describes the significant HIV risk for young women who have older male sexual partners resulting in mixing populations with different HIV prevalence levels [16, 18, 34]. Per capita monthly income in this study setting is R600 (approximately US\$60) per month [35]. Almost 31% of dwellings are described as “informal dwelling” and 30% of people are unemployed [36].

Procedure

We implemented RDS using standard RDS recruitment and analytical methods [37]. Recruitment began with eight non-randomly selected seeds recruited by field staff. Seeds and all subsequent recruits completed a behavioural assessment questionnaire, provided a blood sample for HIV testing, received a cellular telephone voucher valued at R60 (\pm US\$7.50) for participating in the survey, and three recruitment coupons with which to recruit eligible peers into the study. Recruitment coupons provided an

explanation of the study, directions to the study site, contact details for enquiries and a unique recruitment number which was used to link recruiters to their recruits. Eligible recruits received information about the study and provided written informed consent before being interviewed. Dried blood spots were collected and sent to a referral laboratory for analysis. Participants were offered free voluntary counselling and testing and those who accepted were able to obtain their HIV test results on site. Seeds and recruits received an additional telephone voucher valued at R20 (\pm US\$2.50) for each person they recruited who successfully completed the survey.

Sample Size

The required sample size for the study was estimated to be 430. In the absence of HIV prevalence data for HRH in the study setting, the sample size was based on an estimated HIV prevalence of 25% among pregnant women in a geographic area in close proximity to the study setting [38], with a precision of $\pm 5\%$ and a design effect of 1.5. Ethics approval for the study was granted by the Research Ethics Committee of the Faculty of Health Sciences, University of Cape Town.

Measures

Several demographic variables used to describe the study population are shown in Table 2. Levels of socio-economic status (SES) were categorized as: ‘Low,’ reported by participants as, “We don’t have enough money for food,” or “We have enough money for food but not for other basic items such as clothes;” ‘Medium,’ reported by participants as, “We have enough money for food and clothing but are short of many other things,” or “We have the most important things but few luxury goods;” and ‘high,’ reported by participants as, “We have money for luxury goods and extra things.” All other variables used in the analysis are described in Table 1.

Interviews asked questions about three types of female sexual partners: main (steady sexual partner or wife, also known as ‘fasti’ or ‘5–60’), regular (clandestine partners outside of the main relationship, known as ‘khwapeni’), and one-time partners (with whom men had sex with just once and never again). For this paper, “any partner” refers to any of these three types of partners.

Data Analysis

The number of recruitment waves required to reach equilibrium was generated by RDSAT 6.0. Equilibrium is the point at which the sample distribution changes within no more than 2% of the corresponding equilibrium

Table 1 Definitions and coding of variables used in the analysis of intimate partner violence (IPV) and sexual risk

Variables	Survey questions and responses	Coded for analysis
Physical IPV: any physical IPV with any sexual partner in the past 12 months	In the last 12 months, did you (1) slap your [main partner, casual partner, or sexual partner you had sex with just once and never again] or throw something at her? (2) hit your [main partner, casual partner, or sexual partner you had sex with just once and never again] with a fist or something else? (3) threaten to use or actually use a gun, knife or other weapon against your [main partner, casual partner, or sexual partner you had sex with just once and never again]? Response options: yes/no.	0 No to all of these IPV behaviours for all partners 1 Yes to one or more of these IPV behaviours for any partner
Sexual IPV: any sexual IPV with any sexual partner in the past 12 months	(1) In the last 12 months, did you force your [main partner, casual partner, or sexual partner you had sex with just once and never again] to have sex with you when she did not want to? (2) Do you think your [main partner, casual partner, or sexual partner you had sex with just once and never again] had sex with you when she did not want to because she was afraid of what you might do?	0 No to both of these IPV behaviours for all partners 1 Yes to one or more of these IPV behaviours for any partner
Any IPV: any physical or sexual IPV with any partner in the past 12 months		0 No IPV 1 Yes to any one or more of the physical or sexual items above
Problem alcohol use	CAGE ^a questionnaire items: (1) Have you ever felt you should CUT DOWN on your drinking? (2) Have people ANNOYED you by criticizing your drinking? (3) Have you ever felt bad or GUILTY about your drinking? (4) Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover (EYE-OPENER)? Response options: yes/no. Total score range: 0–4.	0 CAGE score < 3 1 CAGE score 3 or 4
Transactional sex (TS) with any most recent sexual partner	Thinking about your most recent [main partner, casual partner, or sexual partner you had sex with just once and never again], do you think she may have become involved with you because she expected you to provide her with, or because you provided her with the following. Response options: yes/no to food, clothes, transport, school fees, cash, cosmetics, pre-paid telephone vouchers, items for her children or family, drinks/a good time	0 No to all these items for all partners 1 Yes to one or more of these items for any partner
Number of sexual partners in past 3 months	How many [main partner, casual partner, or sexual partner you had sex with just once and never again] have you had sex with in the last 3 months?	0 2–5 1 >5
Perception of faithfulness of any most recent sexual partner	Do you think your [main partner, casual partner, or sexual partner you had sex with just once and never again] has other sexual partners? Response options: yes/no.	0 No for all partners 1 Yes for one or more partners
Concurrent sexual partners	Think about the last 3 months, have you been in a sexual relationship with a woman whilst still having a sexual relationship with another? Response options: yes/no.	0 No 1 Yes
Condom use with any sexual partner in the past 3 months	How often have you used condoms with your [main partner, casual partner, or sexual partner you had sex with just once and never again] in the last 3 months? Would you say never, sometimes, often or always?	0 Always 1 Inconsistent (often, sometimes or never)
Symptoms of a sexually transmitted infection (STI) in past 3 months	In the last 3 months have you had any of the following: pain when urinating, discharge (drop) from your penis; sores on your private parts? Response options: yes/no.	0 No symptoms 1 One or more symptoms
HIV status	Serum was eluted from samples and tested with a 4th generation HIV ELISA (Vironostika Uniform II plus 0). Initially reactive samples were re-tested with a 3rd generation (antibody only) HIV ELISA (SD Bioline). Samples that were reactive in both assays were reported as positive. Discordant samples were tested by western blot (HIV1/2 Biorad).	0 Uninfected 1 Infected

^a CAGE: a quick screening tool used to identify problem drinking from four questions [39]. It has been shown to demonstrate reliability and validity across a variety of populations [40]

distribution, even though more individuals enter into the sample. Assuming that all theoretical assumptions are met, equilibrium is an indication that the sample composition is independent of the seeds and therefore independent of the biases introduced by their non-random selection.

We first calculated estimates of population proportions for all socio-demographics and IPV outcomes and HIV risk behaviours using RDS Analysis Tool 6.0 (RDSAT) (www.respondentdrivensampling.org). Then we tested a range of potential confounders for inclusion in multivariate logistic regression models. These confounders included socio-demographic variables and HIV risk behaviours. Variables that altered the point estimate of the association between HIV risk behaviours and IPV outcomes by 10% or more were deemed significant confounders [41] and thus included in the models. We also included those HIV risk variables that were theoretically associated with the IPV outcomes in the models. Outcome variable weights were generated and imported into STATA 10.0 from RDSAT for the multivariate models. Rather than using a sampling frame, RDS uses participants' reported social network sizes to set up selection proportional to degree (network size). This provides the selection probability whereby everyone in someone's social network has an equal probability of selection. To account for biases associated with some participants having larger social network sizes and, therefore, more opportunities to recruit, weighting is set up as the inverse of participants' reported social network sizes (those with larger network sizes are given less weight and vice versa) [30]. Participants' network size was measured by asking about the number of men they knew and who knew them, that were 25 years or older; and had sex with at least one woman in the last 3 months who was five or more years younger than they.

Results

Four hundred and twenty-eight of the required 430 men were recruited into the study. The sample produced up to 15 waves of recruitment, and equilibrium was reached within 2–4 waves of recruitment on the demographic, and the four IPV variables reported in Table 2.

Table 2 shows that men had a median age of 28 years. On the whole, men in the sample were relatively well-educated, and enjoyed relatively good socio-economic standing most likely as a function of the high numbers who were employed. Very few men were married and the majority reported having concurrent sexual partners, and that they thought at least one of these partners had other sexual partners. Almost three quarters of men (72.4%) agreed that a man may have “good reason to hit his girlfriend”, while 61% of men agreed that a “wife should be

expected to be punished by her husband”. Physical IPV was more commonly reported than sexual IPV (36.2 vs. 18.9%), 41.5% reported perpetrating any IPV in the past 12 months with more than a quarter (27.6%) reporting multiple episodes of any IPV in the same time period.

The association between HIV risk behaviours and IPV outcomes are shown in Table 3. Inconsistent condom use was significantly related to any IPV (OR 1.80; CI 1.06, 3.06; $P = 0.031$) but not to the other two categories of IPV. Having experienced at least one symptom of a STI and having engaged in transactional sex with one or more most recent partners were significantly related to physical IPV (OR 2.08; CI 1.30, 3.32; $P = 0.002$ and OR 2.22; CI 1.28, 3.85; $P = 0.005$, respectively), sexual IPV (OR 2.16; CI 1.22, 3.81; $P = 0.008$ and OR 2.67; CI 1.23, 5.80; $P = 0.013$, respectively), and any IPV (OR 1.98; CI 1.24, 3.14; $P = 0.004$ and OR 2.23 CI 1.32, 3.79; $P = 0.003$, respectively). Problem alcohol use was significantly related to physical IPV (OR 1.85; CI 1.20, 2.86; $P = 0.005$), and any IPV (OR 1.77; CI 1.16, 2.70; $P = 0.008$). Having five or more partners in the previous 3 months was significantly related to sexual IPV only (OR 1.73; CI 1.05, 2.86; $P = 0.031$). Perceptions that any most recent sexual partner had other sexual partners were related to physical IPV (OR 2.25; CI 1.19, 4.24; $P = 0.013$), and any IPV (OR 1.82; CI 1.01, 3.28; $P = 0.047$).

Discussion

This study of HRH men who have multiple concurrent partners found high levels of past year IPV perpetration against female sexual partners. Physical IPV appeared to be normative with the majority of men agreeing that a man may have “good reason” to hit his girlfriend and/or punish his wife. While men who have multiple female sexual partners are at increased risk for HIV as a product of having many partners, our results show that those men who engaged in a range of behaviours that increase the risk for HIV transmission to female partners had also been violent.

Very few Southern African studies measured IPV perpetration in the past 12 months, and those that did, were almost exclusively conducted among women victims. We found that 36% of men in our study had perpetrated physical IPV in the past 12 months. This is much higher than that reported by women attending antenatal clinics where it was 25.5% [6], women in three provinces in South Africa (9.5%) [42], and women in Rakai, Uganda where it was 26.9% [43]. IPV perpetration was also much higher than that reported by working class men in Cape Town (8.8%) [13]. Sexual IPV in the past year was reported by 19% of men in our study and was considerably higher than that reported by women attending antenatal clinics where it

Table 2 Population estimates for socio-demographic, intimate partner violence (IPV) outcomes in the past year and HIV risk behaviours among high risk heterosexual men who have multiple female sexual partners

Variables	N/n in sample	% (95% confidence interval)
Demographics		
Age (median: 28 years)		
25–29 years	303/428	68.4 (62.2, 74.3)
30+ years	125/428	31.6 (25.7, 37.8)
Education		
<Grade 8	39/425	8.1 (5.5, 11.2)
Grade 8–11	220/425	55.0 (49.4, 60.7)
Grade 12	166/425	36.9 (31.4, 42.1)
Unemployed	121/414	27.4 (21.2, 31.7)
Cohabiting/married	132/428	33.5 (28.2, 39.6)
Socio-economic status		
Low	98/428	22.9 (17.9, 27.9)
Middle	299/428	69.9 (64.9, 75.2)
High	31/428	7.2 (4.2, 10.3)
HIV Infected	55/403	15.8 (11.1, 20.0)
Intimate partner violence: any partner, past 12 months		
Physical IPV only	160/427	36.2 (30.6, 41.7)
Sexual IPV only	82/428	18.9 (14.5, 23.2)
Physical or sexual IPV	179/428	41.5 (35.7, 47.4)
Physical or sexual IPV > once	123/428	27.6 (23.2, 32.9)
HIV risk behaviours		
Inconsistent condom use: any partner, past 3 months	334/427	76.5 (71.5, 81.3)
Any STI symptom, past 3 months	144/426	33.2 (27.7, 39.1)
Problem alcohol use	233/423	55.0 (49.3, 60.2)
>5 partner numbers in past 3 months	180/428	39.4 (33.3, 45.1)
5+ years older than any last partner	374/427	88.3 (84.8, 91.8)
Any last partner has other sexual partners	333/398	84.3 (78.8, 88.7)
Engages in concurrent partnerships	403/427	94.1 (90.4, 96.9)
Transactional sex with any last partner	340/427	76.8 (71.6, 82.2)

was 9.7% [6], and women in Rakai, Uganda (13.4%) [43]. The rate of past year physical or sexual IPV perpetration found in our study (41.5%) was higher than that reported by women attending antenatal clinics (30.1%) [6]. These findings suggest that men in our study setting who have multiple sexual partners perpetrate past year IPV at much higher rates compared to those reported elsewhere in southern Africa. While recognising that women in the studies cited above may have under-reported being victims of IPV, our hypothesis that HRH men in our study would report higher rates of past-year IPV was largely confirmed.

Among our sample of HRH men, inconsistent condom use was related to any IPV but not to physical or sexual IPV separately. This is contrary to other studies and may be as a result of the decreased variability in our independent variables when separating physical and sexual violence. Other studies found an association between inconsistent condom use among men and having ever raped a woman [10], and lifetime physical and sexual IPV [43], and a

lifetime history of sexual assault among female victims [9] were found. Our findings thus suggest that inconsistent condom use may not be specific to either physically or sexually violent relationships, but rather equally likely in both. Taken together these findings confirm that inconsistent condom use is a feature of violent relationships; whether physical or sexual.

Having reported at least one symptom of a STI in the last 3 months and having engaged in TS with a most recent sexual partner among our study participants were significantly related to all three IPV outcomes. These findings are supported by other studies. For example, men who had been sexually assaultive were more likely to have a history of genital ulcers [20], and women who had a history of sexual assault were more likely to have been diagnosed with a STI and to have had genital ulcers [9]. Additionally, a number of other studies found associations between having engaged in TS and physical and/or sexual IPV [7, 9, 11, 18–20]. The significant association between a STI

Table 3 Logistic regression models showing associations between HIV risk behaviours and intimate partner violence (IPV) outcomes in the past year and among high risk heterosexual men who have multiple female sexual partners

<i>N</i>		Condom use ^a	Sexually transmitted infection ^b	Transactional sex ^c	Problem alcohol use ^d	>5 partners ^e	Partner has others partners ^f						
		OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)						
IPV in the past 12 months													
None		Ref	Ref	Ref	Ref	Ref	Ref						
Physical IPV	160	1.56 (0.91, 2.67)	<i>P</i> = 0.110	2.08 (1.30, 3.32)	<i>P</i> = 0.002	2.22 (1.28, 3.85)	<i>P</i> = 0.005	1.19 (0.80, 1.78)	<i>P</i> = 0.390	2.25 (1.19, 4.24)	<i>P</i> = 0.013		
Sexual IPV	82	1.60 (0.78, 3.29)	<i>P</i> = 0.199	2.16 (1.22, 3.81)	<i>P</i> = 0.008	2.67 (1.23, 5.80)	<i>P</i> = 0.013	1.25 (0.74, 2.11)	<i>P</i> = 0.399	1.73 (1.05, 2.86)	<i>P</i> = 0.031	1.21 (0.58, 2.52)	<i>P</i> = 0.610
Any IPV	179	1.80 (1.06, 3.06)	<i>P</i> = 0.031	1.98 (1.24, 3.14)	<i>P</i> = 0.004	2.23 (1.32, 3.79)	<i>P</i> = 0.003	1.77 (1.16, 2.70)	<i>P</i> = 0.008	1.14 (0.77, 1.69)	<i>P</i> = 0.501	1.82 (1.01, 3.28)	<i>P</i> = 0.047

^a This model adjusted for STI symptoms, problem alcohol use and employment^b This model adjusted for condom use, problem alcohol use and employment, partner has other partners^c This model adjusted for problem alcohol use^d This model has no confounders^e This model adjusted for problem alcohol use^f This model adjusted for employment

symptom and physical IPV found in our sample of HRH men has not been reported elsewhere and suggests that the risk for STI transmission may extend to relationships characterised by physical violence and should be investigated further in future studies. Our findings confirm that sexual relationships characterised by exchange pose a significant risk for IPV for women that is most likely a function of the greater power conveyed to the paying (male) partner in such relationships [15].

Problem alcohol use among this study's participants was significantly related to physical IPV, and any IPV. Likewise, other studies found that alcohol use was significantly associated with physical IPV among working class men, any IPV towards women attending antenatal clinics and Ugandan women [7, 13, 43]. Other studies found that alcohol use was significantly associated with sexual IPV [9, 11, 21], and having raped a non-partner [19]. Contrarily, we did not find a relationship between alcohol use and sexual IPV. It is likely that the different measures of alcohol consumption used by these studies account for this contradiction. Whereas other studies measured whether alcohol was consumed currently and in the past [13], or in conjunction with sex [21, 43] or ever in one's lifetime [9], we used a specific measure to assess problem levels of alcohol use. It is also possible that, as was found among sexually assaultive males [20], alcohol use may not be a feature of sexual violence by men. The association between alcohol use and sexual violence by males needs to be explored in more depth by future studies.

The association between greater numbers of partners in the past 3 months and sexual IPV has been found by a number of other southern African studies that found a significant relationship between numbers of partners and IPV among male perpetrators [11–13, 19, 20], and women who had experienced IPV [7, 9, 43]. Contrary to other study findings, we did not find an association between numbers of partners and physical IPV in our sample of men. This is likely a function of the different ways in which multiple partnerships were quantified: five or more partners in the past 3 months in our study compared to having casual sex among young rural men [11], more than one current sexual partner among working class urban men [13], and more than three sexual partners in the past year among rural women [8]. While it is inexplicable as to why the different quantification of partner numbers did not also produce contradictory findings with respect to sexual IPV, future studies should strive for a more consistent quantification of partner numbers.

We also found an association between whether the men in our study thought any one of their most recent female partners also had other sexual partners and physical and any IPV. This perceived behaviour has not been explored directly in any studies known to the authors and should be

examined in future research as it is a high-risk bridging behaviour that has important implications for the spread of HIV to the general population.

These findings suggest that HRH men in our study setting who have multiple sexual partners and who engage in a range of high-risk behaviours are more likely to perpetrate IPV compared to that reported elsewhere in southern Africa. Our hypothesis that a range of HIV risk behaviours among HRH men in our study would be associated with IPV perpetration was thus confirmed. Observing that these behaviours cluster together in a predictable manner across study settings, Jewkes et al. [8] and Dunkle et al. [11] argue that the associations can be explained by IPV and risky sex having a common origin in a dominant idea of masculinity [8, 11, 19]. This model of masculinity, which emphasizes power and control over women [18], and sexual 'success' with women, not only legitimises the pursuit of multiple female sexual partners (facilitated by the practice of TS [44]) as a means to enhance men's esteem among peers, but also control over sexual encounters and decisions around safe sex practices. Heavy drinking and non-condom use both stem from the same set of ideas, as this model of masculinity that values courage and toughness, which become equated with a lack of concern about health and risks. When one adds the disinhibitive effect and impaired judgement associated with alcohol consumption, we have a context in which risky sexual behaviours are highly prevalent and risk for HIV is greatly enhanced.

This study has a number of limitations. First, the RDS methodology provides representative estimates of people with a particular set of characteristics based upon specific eligibility criteria, and it is, therefore, difficult to estimate what proportion of the total population this group of men represent. Second, the weights are dependent on the degree to which men would have knowledge of their peers' sexual behaviours. Although the validity of this assumption is unknown, qualitative interviews with some of the men found that they socialised in close-knit friendship groups [45]. In these circumstances it is likely that the sexual behaviour of their friends may well have been known. Third, it is impossible to get a measure of reporting bias. Given that our interviewers were all male, men may have felt compelled to over-report behaviours deemed to reflect successful masculinity. Equally, as behaviours that are otherwise socially condemned and illegal, or simply because men forgot, there may have been under-reporting. However, all interviewers were carefully selected and provided training to elicit honest and accurate recall, and to conduct interviews in a non-judgemental manner. Fourth, the provision of incentives may have encouraged men who did not fit the eligibility criteria to misrepresent themselves in order to gain entry into the study. However, we had a staff member who specifically screened each participant for

eligibility using a set of screening questions and we suspect that very few men, if any, who did not fit eligibility were able to enrol. Finally, the age restriction on the younger age of female partners may have resulted in some men being excluded from the study. As the restriction was limited to only one of the female partners and men reported on average five partners (range 2–35) in the previous 3 months, it is unlikely that a significant number of men would have been excluded for this reason.

These study findings demonstrate that men who have multiple female sexual partners are at high risk for HIV infection and transmission. In epidemics characterised by heterosexual transmission of the virus, these men comprise an important bridge for transmitting HIV and should be a focus of future sentinel surveillance. This study also supports the argument that HIV risk reduction interventions for men, particularly those who have multiple female sexual partners, should incorporate strategies to change the underlying construction of masculinity that links the anti-social and risky behaviours of IPV perpetration, inconsistent condom use, multiple concurrent partnering, TS and heavy alcohol consumption. There are evaluated interventions with men, such as Stepping Stones, which have been shown to be effective in addressing all these issues and such interventions should be promoted [46].

References

- Shisana O, Rehle T, Simbayi LC, et al. South African national HIV prevalence, incidence, behaviour and communication survey 2008: a turning tide among teenagers? Cape Town (South Africa): HSRC Press; 2009.
- UNAIDS. Report on the global AIDS epidemic. Geneva (Switzerland): UNAIDS; 2006.
- Mitchell Fuentes CM. Pathways from interpersonal violence to sexually transmitted infections: a mixed-method study of diverse women. *J Womens Health*. 2008;17(10):1591–602.
- Norman R, Bradshaw D, Schneider M, et al. Estimating the burden of disease attributable to interpersonal violence in South Africa 2000. *S Afr Med J*. 2007;97(8):653–5.
- Garcia-Moreno C, Jansen HAFM, Ellsberg M, Heise L, Watts CH. Prevalence of intimate partner violence: findings from the WHO multi-country study on women's health and domestic violence. *Lancet*. 2006;368:1260–9.
- Dunkle KL, Jewkes RK, Brown HC, et al. Prevalence and patterns of gender-based violence and revictimization among women attending antenatal clinics in Soweto, South Africa. *Am J Epidemiol*. 2004;160:230–9.
- Dunkle KL, Jewkes RK, Brown HC, Gray GE, McIntyre JA, Harlow SD. Gender-based violence, relationship power, and risk of HIV infection in women attending antenatal clinics in South Africa. *Lancet*. 2004;363:1415–20.
- Jewkes R, Dunkle K, Nduna M, et al. Factors associated with HIV sero-status in young rural South African women: connections between intimate partner violence and HIV. *Int J Epidemiol*. 2006;35:1461–8.
- Kalichman SC, Simbayi LC. Sexual assault history and risks for sexually transmitted infections among women in an African township in Cape Town, South Africa. *AIDS Care*. 2004;16:681–9.
- Jewkes R, Sikweyiya Y, Morrell R, Dunkle K (2009) Understanding men's health and use of violence: interface of rape and HIV in South Africa [Technical Report]. Pretoria (South Africa): Medical Research Council; 2009 [cited 2009 October 20]. Available from: http://www.mspsouthafrica.org/files/page/264510/violence_hiv.pdf.
- Dunkle KL, Jewkes RK, Nduna M, et al. Perpetration of partner violence and HIV risk behaviour among young men in the rural Eastern Cape, South Africa. *AIDS*. 2006;20:1–8.
- Abrahams N, Jewkes R, Hoffman M, Laubscher R. Sexual violence against intimate partners in Cape Town: prevalence and risk factors reported by men. *Bull World Health Organ*. 2004;82:330–7.
- Abrahams N, Jewkes R, Laubscher R, Hoffman M. Intimate partner violence: prevalence and risk factors for men in Cape Town, South Africa. *Violence Vict*. 2006;21:247–64.
- Jewkes R. Intimate partner violence: causes and prevention. *Lancet*. 2002;359:1423–9.
- Wood K, Jewkes R. “Dangerous” love: reflections on violence among Xhosa township youth. In: Cornwall A, editor. *Readings in gender in Africa*. Bloomington (IN): Indiana University Press; 2005. p. 95–102.
- Luke N. Age and economic asymmetries in the sexual relationships of adolescent girls in sub-Saharan Africa. *Stud Fam Plann*. 2003;34(2):67–74.
- Andersson N, Cockcroft A, Shea B. Gender-based violence and HIV: relevance for HIV prevention in hyperendemic countries of southern Africa. *AIDS*. 2008;22(Suppl 4):S73–86.
- Dunkle KL, Jewkes R, Nduna M, et al. Transactional sex with casual and main partners among young South African men in the rural Eastern Cape: prevalence, predictors, and associations with gender-based violence. *Soc Sci Med*. 2007;65:1235–48.
- Jewkes R, Dunkle K, Koss MP, et al. Rape perpetration by young, rural South African men: prevalence, patterns and risk factors. *Soc Sci Med*. 2006;63:2949–61.
- Simbayi LC, Kalichman SC, Jooste S, Mathiti V, Cain D, Cherry C. HIV/AIDS risks among South African men who report sexually assaulting men. *Am J Health Behav*. 2006;30(2):158–66.
- Hoffman S, O'Sullivan LF, Harrison A, Dolezal C, Monroe-Wise A. HIV risk behaviors and the context of sexual coercion in young adults' sexual interactions: results from a diary study in rural South Africa. *Sex Transm Dis*. 2006;33:52–8.
- Chersich MF, Rees HV. Vulnerability of women in southern Africa to infection with HIV: biological determinants and priority health sector interventions. *AIDS*. 2008;22(Suppl 4):S27–40.
- Shisana O, Simbayi L. Nelson Mandela/HSRC study of HIV/AIDS: South African national HIV prevalence, behavioural risks and mass media household survey. Cape Town (South Africa): HSRC Press; 2002.
- Parker W, Makhubele B, Nlabati P, Connolly C. Concurrent sexual partnerships amongst young adults in South Africa. Challenges for HIV prevention communication [e-report]. Grahamstown (South Africa): CADRE; 2007 [cited 2009 October 9]. Available from: <http://www.cadre.org.za/node/140>.
- Halperin DT, Epstein H. Concurrent sexual partnerships help to explain Africa's high HIV prevalence: implications for prevention. *Lancet*. 2004;364:3–6.
- Soul City. Multiple and concurrent sexual partnerships in Southern Africa: a ten country research report. Johannesburg (South Africa): Soul City; 2008.
- Halperin DT, Epstein H. Concurrent sexual partnerships help to explain Africa's high HIV prevalence: implications for prevention. *Lancet*. 2004;364:3–6.

28. Mah TL, Halperin DT. Concurrent sexual partnerships and the HIV epidemics in Africa: Evidence to move forward. *AIDS Behav* [serial online]. 2008 [cited 2009 October 3]; 2008 July 22. Available from: <http://www.springerlink.com/content/aq8244262614q762/>.
29. Kendall C, Kerr LRFS, Gondim RC, et al. An empirical comparison of respondent-driven sampling, time location sampling, and snowball sampling for behavioral surveillance in men who have sex with men, Fortaleza, Brazil. *AIDS Behav*. 2008;12:S97–104.
30. Heckathorn DD. Extensions of respondent-driven sampling: analyzing continuous variables and controlling for differential recruitment. *Sociol Methodol*. 2007;37:151–207.
31. Malekinejad M, Johnston JG, Kendall C, Kerr LRFS, Rifkin M, Rutherford GW. Using respondent-driven sampling methodology for HIV biological and behavioral surveillance in international settings: a systematic review. *AIDS Behav*. 2008;12:S105–30.
32. Heckathorn D. Respondent driven sampling: a new approach to the study of hidden populations. *Soc Probl*. 1997;44:174–99.
33. Heckathorn D. Respondent driven sampling II: deriving valid population estimates from chain-referral samples of hidden populations. *Soc Probl*. 2002;49(1):11–34.
34. Leclerc-Madlala S. Age-disparate and intergenerational sex in southern Africa: the dynamics of hypervulnerability. *AIDS*. 2008;22(supp. 4):S17–25.
35. Zietsman HL. Recent changes in the population structure of Stellenbosch municipality. Stellenbosch (South Africa): Geographical Systems Research Bureau; 2007.
36. Common Ground Holdings and Neville Naidoo and Associates. Social survey 2005: Stellenbosch Municipality (WC24). Unpublished report compiled for Stellenbosch Municipality, Western Cape Province, South Africa; 2006.
37. Johnston LG. Conducting respondent driven sampling (RDS) Studies in diverse settings: a training manual for planning RDS studies [e-manual]. Centers for Disease Control and Prevention: Atlanta (GA) and Family Health International: Arlington (VA); 2007 [cited 2009 November 2]. Available from: <http://globalhealthsciences.ucsf.edu/PPHG/assets/docs/respondent-driven-sampling-2008.pdf>.
38. Shaikh N, Abdullah F, Lombard CJ, Smit L, Bradshaw D, Makubalo L. Masking through averages—intraprovincial heterogeneity in HIV prevalence within the Western Cape. *S Afr Med J*. 2006;96:538–43.
39. Ewing JA. Detecting alcoholism. *JAMA*. 1968;252:1905–7.
40. Dhallia S, Kopee JA. The CAGE questionnaire for alcohol misuse. A review of reliability and validity studies. *Clin Invest Med*. 2007;30:33–41.
41. Vittenghoff E, Glidden DV, Shiboski SC, McCullough CE. Regression methods in biostatistics: liner, logistic, survival, and repeated measures models. New York (NY): Springer; 2005.
42. Jewkes R, Levin J, Penn-Kekana L. Risk factors for domestic violence: findings from a South African cross-sectional study. *Soc Sci Med*. 2002;55:1603–17.
43. Zablotska IB, Gray RH, Koenig MA, et al. Alcohol use, intimate partner violence, sexual coercion and HIV among women aged 15–24 in Rakai, Uganda. *AIDS Behav*. 2009;13:225–33.
44. Townsend L, Ragnarsson A, Mathews C, Johnston LG, Ekström AM, Thorson A, Chopra M. “Taking Care of Business”: alcohol as currency in transactional sexual relationships among *players* in Cape Town, South Africa. *Qual Health Res*. 2010 (in press).
45. Ragnarsson A, Townsend L, Thorson A, Chopra M, Ekström AM. Social networks and concurrent sexual relationships—a qualitative study among men in an urban South African community. *AIDS Care*. 2009;21(10):1253–8.
46. Jewkes R, Nduna M, Levin J, et al. Impact of Stepping Stones on incidence of HIV and HSV-2 and sexual behaviour in rural South Africa: cluster randomised controlled trial. *BMJ*. 2008;337:a506.

Associations between alcohol misuse and risks for HIV infection among men who have multiple female sexual partners in Cape Town, South Africa

Paper overview

This analysis used combined data from the BBSS conducted in Khayelitsha and Khayamandi in 2008. It provides answers to three questions posed by an international panel of 25 drug and alcohol abuse experts representing eight countries that could further knowledge regarding the links between alcohol use and HIV infection.

Contribution to the thesis and novelty

This paper addresses objective number five of this thesis: to describe the relationship of risky alcohol consumption to risk behaviours and HIV serostatus among HRH men. The panel of experts referred to above suggested that these important questions would require a re-analysis of already available data. This paper was the first to offer such an analysis and thus provide an immediate response to their questions. The paper concludes by being able to provide recommendations for developing and implementing interventions focusing on problem alcohol use and thus the risk of new HIV infections.

Contribution of candidate

The candidate was responsible for protocol development and ethics approval; refinement of the behavioural questionnaire; staff training; project supervision; data capturing and analysis. The first and subsequent drafts of the paper were undertaken by the candidate incorporating co-author and reviewer comments.

Publication status

Submitted for review in *AIDS Care* in December 2009. Accepted for publication on 23rd March 2010. *AIDS Care*. 2010 Sep 6:1-11

Associations between alcohol misuse and risks for HIV infection among men who have multiple female sexual partners in Cape Town, South Africa

Loraine Townsend^{a*}, Samantha R. Rosenthal^b, Charles D.H. Parry^{c,d}, Yanga Zembe^a, Catherine Mathews^{a,e} and Alan J. Flisher^f

^aHealth Systems Research Unit, Medical Research Council, Cape Town, South Africa; ^bDepartment of Community Health, International Health Institute, Warren Alpert Medical School of Brown University, Providence, RI, USA; ^cAlcohol & Drug Abuse Research Unit, Medical Research Council, Cape Town, South Africa; ^dDepartment of Psychiatry, Stellenbosch University, Tygerberg, South Africa; ^eDepartment of Public Health & Family Medicine, University of Cape Town, Cape Town, South Africa; ^fDivision of Child and Adolescent Psychiatry and Adolescent Health Research Unit, University of Cape Town, Cape Town, South Africa

(Received 24 December 2009; final version received 23 March 2010)

The occurrence of high rates of alcohol consumption in a context of high HIV prevalence in South Africa poses a significant health challenge for this country. This paper aims to answer three questions that could further our knowledge regarding the links between alcohol use and HIV infection: (a) “Are problem drinkers more likely to have multiple concurrent partners than those who are not?”; (b) “Are condoms applied less effectively and less consistently by problem drinkers compared to those who are not?”; (c) “Are the female sexual partners of problem drinkers different from those who are not?” Two cross-sectional HIV bio-behavioural surveillance surveys using Respondent-Driven Sampling were conducted in two peri-urban settings on the outskirts of Cape Town, South Africa. Eight hundred and forty-eight men aged 25–55 years who have multiple, concurrent female sexual partners were recruited. Problem drinkers had a score of ≥ 3 on the CAGE questionnaire. Questions enquired about partner numbers, condom use and partner traits. Multivariate logistic regression models were developed to determine significant associations between outcome variables and problem drinking. Fifty-eight percent of men were problem drinkers. Compared to non-problem drinkers, problem drinkers were significantly more likely to report having any symptom of a STI; not using condoms due to drinking; inconsistent condom use with all partner types; that their most recent once-off partner was unemployed; having met their most recent partner at an alcohol-serving venue; and having had a once-off sexual relationship. Alcohol may fuel once-off sexual encounters, often characterised by transactional sex and women’s limited authority to negotiate sex and condom use; factors that can facilitate transmission of HIV. HIV prevention interventions specifically targeting drinkers, the contexts in which problem drinking occurs and multiple sexual partnering are urgently needed.

Keywords: HIV; alcohol misuse; multiple sexual partners; Respondent-Driven Sampling; South Africa

Introduction

A substantial body of scientific literature provides consistent evidence of the strong association between alcohol use and HIV/AIDS. Four recent systematic reviews or meta-analyses conclude that there is a clear association between alcohol use and risk of HIV infection, and between alcohol use and HIV infection. First, problem drinking is consistently associated with an increased risk of sexually transmitted diseases (STDs) across a wide variety of populations internationally (Cook & Clark, 2005). Second, in other international studies, unprotected sex among people living with HIV/AIDS is significantly associated with any alcohol consumption compared to no alcohol consumption, problem alcohol use compared to no or moderate alcohol use, and alcohol use in the context

of sex compared to no alcohol use in the context of sex (Shuper, Joharchi, Irving, & Rehm, 2009). A number of African studies showed that alcohol drinkers compared to non-drinkers and problematic alcohol drinkers compared to non-problematic drinkers were significantly more likely to be infected with HIV (Fisher, Ban, & Kapiga, 2007). Based on a review of studies conducted in sub-Saharan Africa, Kalichman and colleagues concluded that any alcohol use as opposed to none and drinking greater quantities of alcohol compared to lesser quantities, were associated with sexual risks for HIV (Kalichman, Simbayi, Kaufman, Cain, & Jooste, 2007).

The occurrence of high rates of alcohol consumption in a context of high HIV prevalence in South Africa poses a significant health challenge for this country. Southern Africa is home to just 10% of the

*Corresponding author. Email: loraine.townsend@mrc.ac.za

world's population and yet accounts for more than two-thirds of people living with HIV (UNAIDS, 2008). This burden is felt most strongly in South Africa, which has the largest number of people living with HIV (estimated 5.7 million) and one of the highest adult HIV prevalences (18.1%) in the world (UNAIDS, 2008). South Africa also has one of the highest rates of alcohol consumption in the world, estimated to be about 20 litres of pure alcohol per drinker per annum (Rehm et al., 2003). Recognising that heavy drinkers engage in behaviours that place them at considerable risk for HIV infection and transmission, high-risk drinkers (defined as those who score 8 or more on the Alcohol Use Disorders Identification Test (AUDIT) questionnaire) have been classified as a most at risk population (MARF) in the recent South African national HIV prevalence, incidence, behaviour and communication survey (Shisana et al., 2009).

In an attempt to better understand the complex relationship between alcohol use and HIV, a group of international experts met in Cape Town in 2008 to examine the impact of alcohol on HIV and tuberculosis incidence and disease progression. With regard to HIV, the meeting concluded that the role of alcohol on worsening the course of HIV was clear: heavy alcohol use compromises the immune system, and impacts negatively on HIV treatment adherence. With regard to the linkage between alcohol and HIV incidence, the consensus from the meeting was that the relationship between alcohol use and risky sex is multifaceted, reflecting several underlying casual and non-causal processes. The panel identified several questions that, if investigated, could further our knowledge regarding the links between alcohol use and HIV (Parry, Rehm, Poznyak, & Room, 2009).

This paper aims to attempt to answer three of the questions derived from the expert meeting referred to above: (a) "Are men who drink heavily more likely to have multiple concurrent partners than those who do not?"; (b) "Are condoms applied less effectively and less consistently by men who drink heavily compared to those who do not?"; and (c) "Are the female sexual partners of men who drink heavily different from those who do not drink heavily?" (Parry et al., 2009).

Method

Sampling strategy

From June to September 2008, men who had multiple female sexual partners were recruited into two HIV bio-behavioural surveys using Respondent-Driven Sampling (RDS; Heckathorn, 1997, 2002, 2007). One survey was conducted in a peri-urban community on

the outskirts of Cape Town (Site 1); the other in a peri-urban community within a large rural town approximately 60 kilometres from Cape Town (Site 2). In both studies, eligible men lived, worked or socialised in the community in which the study was conducted; were 25–55 years of age; and had sex with two or more female sexual partners in the 3 months prior to the study, one of whom was five or more years younger. These eligibility criteria were chosen because men who have large numbers of, often younger and concurrent female sexual partners, compose a highly efficient network of HIV transmission (Parker, Makhubele, Nlabati, & Connolly, 2007; Soul City, 2008), yet little is known about their HIV-related risk behaviours.

Eight non-randomly selected seeds (initial recruits) who met the eligibility criteria began the recruitment of participants. Seeds and recruits received a telephone voucher worth R60 (\pm US\$6) for completing the survey. They also received three recruitment coupons which they used to recruit their eligible peers into the study. The recruitment coupons were numbered with unique numbers used to track who recruited whom. Seeds and recruits received an additional telephone voucher worth R30 (\pm US\$3) for each of their recruits who successfully completed the survey. Ethical clearance was obtained from the Research Ethics Committee, Faculty of Health Sciences, University of Cape Town.

Survey instrument

The survey consisted of 113 questions about participants' and female sexual partners' demographics, participants' current and past sexual risk behaviours, concurrency (i.e., having begun a sexual relationship with a woman while still engaged in a sexual relationship with another), history of sexually transmitted infections and alcohol use. Formative research identified three types of female sexual partners: main (steady sexual partner or wife), casual (clandestine partners outside of the main relationship) and once-off partners (with whom men had sex with just once and never again).

This paper examines the sexual behaviours and sexual partner traits of eligible men who were categorised as problem drinkers or non-problem drinkers using the CAGE questionnaire, an instrument that has been shown to demonstrate reliability and validity across a variety of populations (Dhalla & Kopee, 2007; Ewing, 1968). Response options on the questionnaire allowed for a total score of between 0 and 4 for each participant (see Table 1). A cut-off score of ≥ 3 was used to classify participants as problem drinkers. Another question included in the survey was: "How often in the past year did you have sex without a

Table 1. Definitions and coding of variables used in the analysis.

Outcome variables	Survey questions and responses		Coded for analysis
Condom use indicators			
1. Condom use with main sexual partner(s) past 3 months	How often have you used condoms with your [main partner, casual partner, or sexual partner you had sex with just once and never again] in the last 3 months? Would you say never, sometimes, often or always?	1	Always
2. Condom use with casual sexual partner(s) past 3 months		2	Inconsistent (often/sometimes)
3. Condom use with once-off sexual partner(s) past 3 months		3	Never
4. Sex without condom due to drinking past 12 months	How often in the past year did you have sex without a condom because of your drinking? Was it never, rarely, sometimes or often?	1	Never or rarely
		2	Sometimes or often
Sexual partner traits			
5. Had once-off sexual partner(s) past 3 months	How many once-off partners have you had sex with in the last 3 months?	0	None = NO
		1	1 + partners = YES
6. Most recent main partner employment	Think about the last [main partner, casual partner, once-off partner] you had sex with. What does she do for a living?	0	Unemployed
7. Most recent casual partner employment		1	Employed (excluding 'don't know' or missing responses)
8. Most recent once-off partner employment			
9. Met most recent main partner at a shebeen ^a /tavern	Where did you meet your last [main partner, casual partner, once-off partner]? Response options: Shebeen/tavern, bar, restaurant, sports club/game, nightclub, braai, friend's house, other.	0	No
10. Met most recent casual partner at a shebeen/tavern		1	Yes
11. Met most recent once-off partner at a shebeen/tavern			
Drinking status variable			
PROBLEM ALCOHOL USE AS MEASURED BY THE CAGE QUESTIONNAIRE			
Have you ever felt you should CUT DOWN on your drinking?	Never	0	No
Have people ANNOYED you by criticizing your drinking?	Sometimes, often or rarely	1	Yes
Have you ever felt bad or GUILTY about your drinking?			
Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover (EYE-OPENER)?"			

^aA "shebeen" is an informal venue where alcohol is served, largely unregulated in the study settings.

condom because of your drinking?" Response options were either "never" (coded as No) or one of "sometimes", "often", "rarely" (coded as Yes). The definitions and coding for analysis of the outcome variables are detailed in Table 1.

Procedures

We implemented RDS using standard RDS recruitment and analytical methods (Johnston, 2007). Eligible recruits received information about the study and

provided written informed consent before being interviewed by a trained interviewer. The survey was administered by trained interviewers in either the home language of the participants, which was isiXhosa, or English. Dried blood spots (DBS) were collected by a trained nurse.

Biological testing

The DBS samples were sent to a referral laboratory for anonymous HIV testing, where serum was eluted

180

185

from samples and tested with a fourth-generation HIV ELISA (Vironostika Uniform II plus 0). Initially, reactive samples were re-tested with a third-generation (antibody only) HIV ELISA (SD Bioline). Samples that were reactive in both assays were reported as positive. Discordant samples were tested by western blot (HIV1/2 Biorad).

Data analysis

We first compared participants from Site 1 to those from Site 2 on demographic characteristics with Chi-square tests using STATA, 10.0. We then compared problem and non-problem drinkers on sociodemographic and sexual behaviour categories. In these analyses, we estimated odds ratios of drinking status by all independent variables separately and adjusting for study site. We then examined whether there were any interactions between study site and all independent variables. Finally, we developed multinomial and multivariable logistic regression models for each of the 11 outcome variables as applicable to determine which variables were significantly associated with problem drinking, controlling statistically for study site and all identified confounders. The following categorical variables were assessed for confounding for each logistic regression model: marital status, age, education and employment. Potential confounders were included in the final adjusted model if, when independently controlled for, altered the odds ratio by 10% or more (Vittinghoff, Glidden, Shiboski, & McCullough, 2005). Outcome variable weights were generated and imported into STATA 10.0 from Respondent-Driven Sampling Analysis Tool 6.0 (RDSAT; www.respondentdrivensampling.org). This weighting takes into account the variation in participants' network sizes (degree weight), differential recruitment effectiveness across groups and homophily (recruitment weight; Heckathorn, 2007). All odds ratios and corresponding *p*-values were calculated using STATA, 10.0.

Results

Eight hundred and forty-eight men participated in the surveys. Men in the combined samples reported having a mean of five female sexual partners in the 3 months prior to the studies (range 2–35), and 94% reported concurrent relationships having answered affirmatively to the question: “think about the last 3 months, have you been in a sexual relationship with one woman whilst still having a sexual relationship with another?” Compared to men from Site 2, those from Site 1 were more likely to be employed (59.5% vs. 41.8%). Men were not significantly different

across study sites on all other demographic characteristics.

Problem drinkers were not significantly different from non-problem drinkers on demographic characteristics, but significantly more problem drinkers drank five or more alcoholic drinks on the last occasion (Table 2). Compared to non-problem drinkers, problem drinkers were significantly more likely to report any symptom of a STI in the past three months and that they thought themselves likely to have HIV (Table 2). All other sexual behaviour and sexual health characteristics were not significantly different by drinking status. We found no significant interactions between study site and the independent variables.

Significantly, more problem drinkers compared to non-problem drinkers reported that they went to shebeens (unlicensed liquor outlets operating out of homes or backyard shacks) or taverns (larger outlets, typically licensed) most often in the past month with their friends (65.8% vs. 55.9%), visited these venues more than six times in the last month (58.0% vs. 49.0%), spent more than 6 hours at these venues on the last occasion (56.8% vs. 49.3%), reported meeting new sexual partners most often at these venues (78.6% vs. 61.3%) and reported that their friends went to these venues most often to meet new sexual partners (63.3% vs. 44.3%). More than half of the men ($n = 496$: 58.5%) met the definition for problem drinking.

Four different condom use indicators were examined as outcomes (Table 3) for which no confounders were identified. When controlling for study site, problem drinkers compared to non-problem drinkers were significantly more likely to use condoms inconsistently or never with main and casual partners in the 3 months prior to the survey, and significantly more likely to use condoms inconsistently but not never with once-off partners. Problem drinkers compared to non-problem drinkers were more likely to report not having used a condom in the past year due to drinking.

The remaining seven outcomes refer to traits of the study participants' female sexual partners. Problem drinkers compared to non-problem drinkers were more likely to report that their most recent once-off partner was unemployed; to report having met their most recent main, casual and once-off partners at a shebeen or tavern; and more likely to have had at least one once-off sexual relationship in the three months prior to the survey (Table 4).

Discussion

The majority of men who have multiple, concurrent female sexual partners in our studies drank at levels

Table 2. Demographic characteristics, quantity of alcoholic drinks consumed on the last occasion, sexual behaviour, sexual health characteristics of male adults aged 25–55 years ($n = 848$) by drinking status.

	Non-problematic drinkers		Problematic drinkers		AOR (adjusted for site) (95% CI)	<i>p</i>
	<i>n</i>	Percentage (%)	<i>n</i>	Percentage (%)		
Total	352	41.5	496	58.5		
Demographic characteristics						
Study site						
Study Site 1	159	45.2	263	53.0	1.00	
Study Site 2	193	54.8	233	47.0	0.88 (0.67, 1.16)	0.369
Marital status						
Not married	310	89.9	462	93.3	1.00	
Married	35	10.1	33	6.7	1.55 (0.94, 2.56)	0.092
Age						
25–29	240	69.6	336	67.7	1.00	
30–44	94	27.2	146	29.4	1.11 (0.82, 1.51)	0.533
45–55	11	3.2	14	2.8	0.86 (0.38, 1.92)	0.625
Education						
<8 years	34	9.9	35	7.2	1.00	
8–11 years	172	50.2	261	53.5	1.46 (0.88, 2.43)	0.156
12 years	137	39.9	192	39.3	1.35 (0.80, 2.27)	0.281
Employment						
Unemployed	122	34.7	174	35.1	1.00	
Employed	204	57.9	298	60.1	1.06 (0.79, 1.41)	0.577
Students	26	7.4	24	4.8	0.63 (0.34, 1.15)	0.116
Alcoholic drinks consumed on the last occasion, sexual behaviour, sexual health characteristics						
Quantity of alcohol consumed on the last occasion						
None or <5 drinks	156	45.4	123	24.9	1.00	
5+ drinks	188	54.7	372	75.1	2.54 (1.89, 3.41)	0.000
Sexual partners past 3 months						
<3	131	37.2	164	33.1	1.00	
4+	221	62.8	332	66.9	1.24 (0.93, 1.65)	0.101
Concurrent partners past 3 months						
No	19	5.5	30	6.1	1.00	
Yes	325	94.5	463	93.9	0.91 (0.50, 1.65)	0.773
Any symptom of a STI past 3 months						
No	265	77.0	349	70.5	1.00	

Table 2 (Continued)

	Non-problematic drinkers		Problematic drinkers		AOR (adjusted for site) (95% CI)	p
	n	Percentage (%)	n	Percentage (%)		
Yes	79	23.0	146	29.5	1.45 (1.06, 1.99)	0.012
HIV status						
Negative	275	84.9	401	85.9	1.00	1.00
Positive	49	15.1	66	14.1	0.92 (0.61, 1.37)	0.662
Self-reported likelihood of HIV						
Likely	179	52.1	327	66.3	1.00	1.00
Unlikely	164	47.8	166	33.7	1.81 (1.37, 2.41)	0.000

Note: OR, odds ratios of drinking status (problematic vs. non-problematic) by all independent variables separately; AOR, odds ratios of drinking status (problematic vs. non-problematic) by all independent variables separately, adjusted for study site; CI, confidence intervals.

suggesting problematic drinking. They socialised most often at shebeens or taverns and met new sexual partners there. Their already high HIV risk profile was exacerbated by a greater propensity for STIs, inconsistent and non-condom use, and multiple once-off sexual encounters. They may have been aware of their elevated HIV risk as they perceived themselves likely to be infected with HIV.

Other studies found lower rates of problem alcohol use than in our study, suggesting that men who have multiple partners in our study contexts are at elevated risk for alcohol problems. Findings from the first demographic and health survey in South Africa (Parry et al., 2005) revealed lifetime problem drinking (defined as ≥ 2 on the CAGE questionnaire) in 27.9% of men in urban contexts in the Western Cape, considerably lower than the 58.5% found among men in our study contexts – also in the Western Cape.

Findings from our study confirmed those from other research in peri-urban contexts in South Africa that identified shebeens and taverns where men commonly met to socialise as places where extensive and diverse social networks, characterised by high rates of new sexual partner formation, concurrency and low condom use are common (Moroejele et al., 2006; Weir, Morroni, Coetzee, Spencer, & Boerma, 2002; Weir et al., 2003). The absence of alternative forms of leisure activity and the paucity of recreational facilities available in the study settings is common in urban and peri-urban communities in South Africa (Moroejele et al., 2006).

Given that alcohol use is strongly related to STI (Cook & Clark, 2005), it was not unexpected that problem drinkers in our study were more likely than non-problem drinkers to report symptoms of STI in the 3 months prior to the study. That men in our study who thought they were likely to be infected with HIV were also more likely to be problem drinkers, has not been assessed in previous work. This finding suggests that alcohol may be used to mitigate the stress of thinking one is infected with HIV and adds another benefit to knowing one's HIV status.

With regard to the first question derived from Parry and colleagues (Parry et al., 2009), we found that problem drinkers were not more likely than non-problem drinkers to have four or more partners in the past three months (66.9% vs. 62.7%). Our findings differed from Kalichman, Simbayi, Jooste and Cain (2007) who found that greater numbers of sexual partners among male and female STI patients in Cape Town was related to greater frequency and quantities of alcohol consumption. However, whereas they measured quantity and frequency of drinking as

Table 3. Associations between condom use indicators and drinking status, controlling for study site.

Drinking status	Frequency of condom use past 3 months ^a							
	Main partner/s				Casual partner/s			
	Always N (%)	Inconsistent N (%)	Never N (%)	Always N (%)	Inconsistent N (%)	Never N (%)	Always N (%)	Once-off partner/s Inconsistent N (%)
Non-problem	103 (55.1)	76 (32.3)	148 (40.6)	214 (46.0)	70 (33.3)	51 (37.0)	146 (44.7)	40 (26.9)
Problem	84 (44.9)	159 (67.7)	217 (59.5)	251 (54.0)	140 (66.7)	87 (63.0)	181 (55.4)	109 (73.2)
RRR (CI)	1.00	2.39 (1.60, 3.59)	1.86 (1.29, 2.66)	1.00	1.63 (1.16, 2.30)	1.57 (1.06, 2.35)	1.00	2.09 (1.36, 3.21)
P		0.000	0.001		0.005	0.026		0.001
	Non-condom use, any partner, past year due to drinking ^b							
	Sometimes/often N (%)				Rarely/never N (%)			
Drinking status							AOR (95% CI)	p
Non-problem		123 (27.0)				158 (49.0)	1.00	
Problem		332 (73.0)				164 (50.9)	2.62 (1.94, 3.55)	0.000

^aMultinomial logistic regression analysis including outcome variable weights generated by RDSAT.^bLogistic regression analysis including outcome variable weights generated by RDSAT.

Note: RRR, relative risk ratios of condom use variables by drinking status (problematic vs. non-problematic), adjusted for study site; CI, confidence intervals; AOR, odds ratio of non-condom use due to drinking by drinking status (problematic vs. non-problematic), adjusted for study site.

Table 4. Associations between sexual partner traits and drinking status, controlling for study site.

Most recent partner employed												
Main partner				Casual partner				Once-off partner ^a				
Drinking status	No N (%)	Yes N (%)	AOR (95% CI)	p	No N (%)	Yes N (%)	AOR (95% CI)	p	No N (%)	Yes N (%)	AOR (95% CI)	p
Non-problem	43 (35.8)	291 (41.9)	1.00		51 (38.4)	290 (41.5)	1.00		224 (40.4)	15 (24.2)	1.00	
Problem	77 (64.1)	404 (58.1)	0.71 (0.47,1.08)	0.110	82 (61.7)	409 (58.5)	0.85 (0.58,1.24)	0.388	330 (59.6)	47 (75.8)	2.36 (1.25,4.47)	0.008
Met most recent partner at a shebeen/tavern												
Main partner				Casual partner				Once-off partner				
Drinking status	No N (%)	Yes N (%)	AOR (95% CI)	p	No N (%)	Yes N (%)	AOR (95% CI)	p	No N (%)	Yes N (%)	AOR (95% CI)	p
Non-problem	268 (42.7)	67 (35.1)	1.00		195 (50.5)	147 (32.9)	1.00		99 (44.8)	140 (35.3)	1.00	
Problem	360 (57.3)	124 (64.9)	1.44 (1.03,2.01)	0.035	191 (49.5)	300 (67.1)	2.12 (1.60, 2.82)	0.000	122 (55.2)	257 (64.7)	1.59 (1.13, 2.23)	0.008
Had a one-off partner past 3 months												
Drinking status	No N (%)		Yes N (%)		AOR (95% CI)		p		AOR (95% CI)		p	
Non-problem	114 (47.1)		231 (38.6)						1.00			
Problem	128 (52.9)		368 (61.4)						1.49 (1.10, 2.02)		0.011	

^aThis model also controlled for education.

Note: AOR, odds ratios of partner traits by drinking status (problematic vs. non-problematic), adjusted for study site; CI, confidence intervals. Logistic regression analysis includes outcome variable weights generated by RDSAT.

indicators of heavy drinking, in our study we classified men as problem/non-problem drinkers using the CAGE questionnaire and these differences may account for the different findings.

While we were unable to provide a definitive answer to the question, “Are condoms applied less effectively and consistently by men who drink heavily compared to those who do not?”, what this study does provide, however, is the knowledge that problem drinkers were likely to report not using condoms due to their drinking. This knowledge, in conjunction with the finding of inconsistent and non-condom use in the previous 3 months, confirms conclusions from other studies that among heavy drinkers, condom use is inconsistent if at all (Kalichman, Simbayi, Vermaak, Jooste, & Cain, 2008; Simbayi, Mwaba, & Kalichman, 2006; World Health Organization [WHO], 2005).

Finally, to answer the question whether the female sexual partners of men who drink heavily differ from those who do not drink heavily, we examined a number of traits of female partners. We found that problem drinkers were more likely to have once-off sexual encounters with women who were more likely to be unemployed. Once-off partners are arguably the “riskiest” of all sexual partner types because little is known about them, particularly their past and current HIV risk profile, which raises the already high HIV risk of men who have multiple partners, who drink heavily and who mostly practice unsafe sex. The fact that once-off partners were unemployed could suggest that these women engaged in sex with men for economic reciprocity, a common occurrence in sub-Saharan Africa (Hawkins, Mussa, & Abuxahama, 2005; Leclerc-Madlala, 2003). In situations where alcohol and/or money are exchanged for sex, women are likely less able to negotiate the terms on which sex takes place between her and her partner, including condom use (Kaufman & Stavrou, 2004; Luke, 2003; Silberschmidt & Rasch, 2001; Wojcicki & Malala, 2001). Ultimately, the study findings imply that alcohol may actually fuel once-off sexual encounters, which are most often characterised by transactional sex, and women’s limited authority to negotiate sex and condom use, all of which are factors that can facilitate the transmission of HIV.

Given that men in our studies spent a great deal of their leisure time at shebeens and taverns, it is not surprising that they commonly met their most recent casual and once-off partners at these venues. It is probable that women who frequent shebeens and taverns also drink alcohol, suggesting that the partners of men who drink heavily may also drink alcohol. Among STI patients in Cape Town, inconsistent

condom use was significantly related to situations where both partners drank alcohol (Kalichman, Simbayi et al., 2007), confirming our findings of inconsistent and non-condom use among problem drinkers. Further, another study conducted among shebeen patrons in Cape Town found that people who met sexual partners at shebeens drank greater quantities of alcohol more frequently, had higher scores on the AUDIT, were more likely to have a STI, engage in transactional sex, have two or more sexual partners in the past months and have more unprotected sex (Kalichman et al., 2008). Our findings are remarkably similar to these.

While the results from these studies begin to address the important gaps in our knowledge about the association between alcohol use and HIV, the studies have some limitations. First, the RDS methodology provides representative estimates of people with a particular set of characteristics based upon specific eligibility criteria, and it is, therefore, difficult to estimate what proportion of the total population this group of men represent. Second, given that our interviewers were all male, men may have over-reported behaviours perceived to be admired by fellow men. However, all interviewers were carefully selected and provided training to elicit honest and accurate recall, and to conduct interviews in a non-judgmental manner. Third, our conservative categorisation of problem drinkers on the CAGE questionnaire (score ≥ 3) may have underestimated the number of problem drinkers among men who have multiple, concurrent partners. Finally, we did not measure the frequency of sex with other men among our sample. Given that sex with other men is an important risk factor for HIV and likely influences condom use consistency with female sexual partners, it is suggested that future research should examine the frequency of this behaviour among men who might identify themselves as heterosexual but might also have sex with other men.

In conclusion, data already collected from men who have multiple, concurrent female sexual partners in two study settings close to Cape Town has provided initial insight into the questions posed by the international panel in 2008 (Parry et al., 2009). Men who have multiple, concurrent partners drink at problematic levels and have elevated HIV risk profiles given their higher incidence of STI, inconsistent and non-condom use and engaging in sex with once-off, unemployed sexual partners. These findings add to the growing body of evidence that problem drinkers are indeed MARP and that HIV prevention interventions specifically targeting drinkers, the contexts in which problem drinking occurs and multiple, concurrent sexual partnering are urgently needed.

Acknowledgements

We would acknowledge the provincial administration of the Western Cape Department of Health: Provincial health programmes for providing funding for these studies. We also acknowledge the dedicated fieldworkers and the many willing participants.

References

- Cook, R.L., & Clark, D.B. (2005). Is there an association between alcohol consumption and sexually transmitted diseases? A systematic review. *Sexually Transmitted Diseases*, 32, 156–164.
- Dhalla, S., & Kopee, J.A. (2007). The CAGE questionnaire for alcohol misuse. A review of reliability and validity studies. *Clinical and Investigative Medicine*, 30, 33–41.
- Ewing, J.A. (1968). Detecting alcoholism. *Journal of the American Medical Association*, 252, 1905–1907.
- Fisher, J.C., Bang, H., & Kapiga, S.H. (2007). The association between HIV infection and alcohol use: A systematic review and meta-analysis of African studies. *Sexually Transmitted Diseases*, 34, 856–863.
- Hawkins, K., Mussa, F., & Abuxahama, S. (2005). “Milking the Cow”. *Young women’s constructions of identity, gender, power and risk in transactional and cross-generational sexual relationships: Maputo, Mozambique*. Swansea: Centre for Development Studies.
- Heckathorn, D. (1997). Respondent driven sampling: A new approach to the study of hidden populations. *Social Problems*, 44, 174–199.
- Heckathorn, D. (2002). Respondent driven sampling II: Deriving valid population estimates from chain-referral samples of hidden populations. *Social Problems*, 49, 11–34.
- Heckathorn, D.D. (2007). Extensions of respondent-driven sampling: Analyzing continuous variables and controlling for differential recruitment. *Sociological Methodology*, 37, 151–207.
- Johnston, L.G. (2007). *Conducting respondent driven sampling (RDS) studies in diverse settings: A training manual for planning RDS studies*. Retrieved from <http://globalhealthsciences.ucsf.edu/PPHG/assets/docs/respondent-driven-sampling-2008.pdf>
- Kalichman, S.C., Simbayi, L.C., Jooste, S., & Cain, D. (2007). Frequency, quantity, and contextual use of alcohol among sexually transmitted infection clinic patients in Cape Town, South Africa. *American Journal of Drug & Alcohol Abuse*, 33, 687–698.
- Kalichman, S.C., Simbayi, L.C., Kaufman, M., Cain, D., & Jooste, S. (2007). Alcohol use and sexual risks for HIV/AIDS in sub-Saharan Africa: Systematic review of empirical findings. *Prevention Science*, 8, 141–151.
- Kalichman, S.C., Simbayi, L.C., Vermaak, R., Jooste, S., & Cain, D. (2008). HIV/AIDS risks among men and women who drink at informal alcohol serving establishments (shebeens) in Cape Town, South Africa. *Prevention Science*, 9, 55–62.
- Kaufman, C.E., & Stavrou, S.E. (2004). ‘Bus fare please’: The economics of sex and gifts among young people in urban South Africa. *Culture, Health & Sexuality*, 6, 377–391.
- Leclerc-Madlala, S. (2003). Transactional sex and the pursuit of modernity. *Social Dynamics*, 29, 213–233.
- Luke, N. (2003). Age and economic asymmetries in the sexual relationships of adolescent girls in sub-Saharan Africa. *Studies in Family Planning*, 34, 67–74.
- Morojele, N.K., Kachieng’a, M.A., Mokoko, E., Nkoko, M.A., Parry, C.D.H., Nkowane, A.M., ... Moshia, K.M. (2006). Alcohol use and sexual behaviour among risky drinkers and bar and shebeen patrons in Gauteng province, South Africa. *Social Science & Medicine*, 62, 217–227.
- Parker, W., Makhubele, B., Nlabati, P., & Connolly, C. (2007). *Concurrent sexual partnerships amongst young adults in South Africa. Challenges for HIV prevention communication*. Retrieved from <http://www.cadre.org.za/node/140>
- Parry, C.D.H., Plüddemann, A., Steyn, K., Bradshaw, D., Norman, R., & Laubscher, R. (2005). Alcohol use in South Africa: Findings from the first demographic and health survey (1998). *Journal of Studies on Alcohol*, 66, 91–97.
- Parry, C., Rehm, J., Poznyak, V., & Room, R. (2009). Alcohol and infectious diseases: An overlooked causal linkage? *Addiction*, 104, 331–332.
- Rehm, J., Rehn, N., Room, R., Monteiro, M., Gmel, G., Jernigan, J., & Frick, U. (2003). The global distribution of average volume of alcohol consumption and pattern of drinking. *European Addiction Research*, 9, 147–156.
- Shisana, O., Rehle, T., Simbayi, L.C., Zuma, K., Jooste, S., Pillay-Van Wyk, V., ... Mbelle, N. (2009). *South African national HIV prevalence, incidence, behaviour and communication survey, 2008: A turning tide among teenagers?* Cape Town: HSRC Press.
- Shuper, P.A., Joharchi, N., Irving, H., & Rehm, J. (2009). Alcohol as a correlate of unprotected sexual behavior among people living with HIV/AIDS: Review and meta-analysis. *AIDS & Behavior*, 13, 1021–1036.
- Silberschmidt, M., & Rasch, V. (2001). Adolescent girls, illegal abortions and “sugar-daddies” in Dar es Salaam: Vulnerable victims and active social agents. *Social Science & Medicine*, 52, 1815–1826.
- Simbayi, L.C., Mwaba, K., & Kalichman, S.C. (2006). Perceptions of the combination of HIV/AIDS and alcohol as a risk factor among STI clinic attenders in South Africa: Implications for HIV prevention. *Social Behavior and Personality*, 34, 535–544.
- Soul City (2008). *Multiple and concurrent sexual partnerships in Southern Africa: A ten country research report*. Johannesburg: Author.
- UNAIDS (2008). *Report on the global AIDS epidemic*. Geneva: Author.
- Vittenghoff, E., Glidden, D.V., Shiboski, S.C., McCullough, C.E. (2005). *Regression methods in biostatistics: Linear, logistic, survival, and repeated measures models*. New York: Springer.

- 570 Weir, S.S., Morroni, C., Coetzee, N., Spencer, J., &
Boerma, J.T. (2002). A pilot study of a rapid assess-
ment method to identify places for AIDS prevention in
Cape Town, South Africa. *Sexually Transmitted Infec-*
tions, 78(Suppl. 1), S106–113.
- 575 Weir, S., Pailman, C., Mahlalela, X., Coetzee, N., Meidant,
F., & Boerma, J.T. (2003). From people to places:
Focusing AIDS prevention efforts where it matters
most. *AIDS*, 17, 895–903.
- Wojcicki, J.M., & Malala, J. (2001). Condom use, power
and HIV/AIDS risk: Sex-workers bargain for survival
in Hillbrow/Joubert Park/Berea, Johannesburg. *Social*
Science & Medicine, 53, 99–121.
- World Health Organization (2005). *Alcohol use and sexual*
risk behaviour: A cross-cultural study in eight countries.
Geneva: Author.
- 580
- 585

“Taking Care of Business”: Alcohol as Currency in Transactional Sexual Relationships Among *Players* in Cape Town, South Africa.

Paper overview

This analysis used qualitative data from individual interviews conducted with men participating in the larger BBSS in Khayelitsha in 2006. Findings highlight the latent association between alcohol and transactional sex and provide an in-depth examination of the normative role that alcohol plays in the formation of casual sexual partnerships.

Contribution to the thesis and novelty

This paper addresses objective number six of the thesis: to explore the dynamics in sexual relationships characterized by exchange. It provides one of the few examinations of heterosexual men’s perspectives of social and transactional sexual relationships. The paper builds on an existing conceptual model that traces the potential pathways by which alcohol use and transactional sex are linked to sexual risk behaviors and thus provides a more nuanced understanding of the relationship between alcohol use and sexual risk behaviours. Recommendations for targeted interventions are provided on the basis of the expanded conceptual model.

Contribution of candidate

The candidate was responsible for assisting with the development of the interview guide; obtaining ethics approval; and on-site project management. The candidate was responsible for data analysis and in the writing of the first and all subsequent drafts of this paper, integrating co-author and reviewer comments.

Publication status

Submitted for review to *Qualitative Health Research* in June 2009, and accepted for publication on 14th January 2010. Published online before print, 29 July 2010; doi: 10.1177/1049732310378296.

Qualitative Health Research

<http://qhr.sagepub.com/>

"Taking Care of Business": Alcohol as Currency in Transactional Sexual Relationships Among Players in Cape Town, South Africa

Loraine Townsend, Anders Ragnarsson, Catharine Mathews, Lisa Grazina Johnston, Anna Mia Ekström, Anna Thorson and Mickey Chopra

Qual Health Res published online 29 July 2010

DOI: 10.1177/1049732310378296

The online version of this article can be found at:

<http://qhr.sagepub.com/content/early/2010/07/28/1049732310378296>

Published by:



<http://www.sagepublications.com>

Additional services and information for *Qualitative Health Research* can be found at:

Email Alerts: <http://qhr.sagepub.com/cgi/alerts>

Subscriptions: <http://qhr.sagepub.com/subscriptions>

Reprints: <http://www.sagepub.com/journalsReprints.nav>

Permissions: <http://www.sagepub.com/journalsPermissions.nav>

“Taking Care of Business”: Alcohol as Currency in Transactional Sexual Relationships Among Players in Cape Town, South Africa

Qualitative Health Research
XX(X) 1–10
© The Author(s) 2010
Reprints and permission: <http://www.sagepub.com/journalsPermissions.nav>
DOI: 10.1177/1049732310378296
<http://qhr.sagepub.com>


Loraine Townsend,¹ Anders Ragnarsson,²
Catherine Mathews,¹ Lisa Grazina Johnston,³
Anna Mia Ekström,² Anna Thorson,² and Mickey Chopra⁴

Abstract

In this article we examine the dynamics of social relationships in which alcohol use and risky sexual behaviors cooccur. As part of a larger biological and behavioral HIV surveillance survey, 20 men who lived in an urban, informal settlement on the outskirts of Cape Town, South Africa participated in in-depth interviews. Interview transcripts were analyzed according to a latent content analysis. Findings highlight the latent association between alcohol and transactional sex, and enable an in-depth examination of the normative role that alcohol plays in the formation of casual sexual partnerships characterized by exchange. We build on an existing conceptual model that traces the potential pathways by which alcohol use and transactional sex are linked to sexual risk behaviors. The study findings point to the need for multilevel HIV risk-reduction interventions among men to reduce excessive alcohol use, risky sexual behaviors, and underlying perceptions of ideal masculinity.

Keywords

Africa, South; alcohol / alcoholism; behavior change; HIV/AIDS prevention; masculinity; sexuality / sexual health

South Africa has the largest number of people living with HIV (estimated at 5.7 million) and one of the highest HIV prevalence rates (18.1%) in the world (Joint United Nations Program on HIV/AIDS, 2008). Although sentinel site surveillance data suggest that prevalence might be declining, or at least reaching a plateau (South African Department of Health, 2008), HIV continues to be a major health challenge in this country.

Studies conducted in sub-Saharan Africa show that alcohol use is significantly associated with HIV-related sexual risk behaviors and HIV infection. The rate of alcohol consumption in South Africa among those who drink alcohol is estimated to be approximately 20 litres (approximately five U.S. gallons) of pure alcohol per drinker per annum—one of the highest rates of alcohol consumption in the world (Schneider et al., 2007). A third of these drinkers report heavy, episodic (binge) drinking (i.e., five or more drinks on any one day among men, and three or more among women) over weekends (Parry, 2005). This volume and pattern of drinking, defined as “risky” drinking (South African Department of Health, 1998), carries a high risk

of intoxication and acute and chronic health consequences, including increased morbidity and mortality from intentional and unintentional injuries, and more than 60 identified adverse health outcomes (Schneider et al., 2007).

Researchers in a systematic review and meta-analysis of 20 African studies (Fisher, Bang, & Kapiga, 2007) and a study of women in Uganda (Zablotska et al., 2006) found that high levels of alcohol consumption were associated with HIV seropositivity and seroconversion. Other studies have shown that alcohol use is associated with an array of risky sexual behaviors (Kalichman, Simbayi, Kaufman, Cain, & Jooste, 2007), including inconsistent condom use

¹Medical Research Council, Cape Town, South Africa

²Karolinska Institutet, Stockholm, Sweden

³Tulane University, New Orleans, Louisiana, USA

⁴United Nations Children’s Fund, New York, New York, USA

Corresponding Author:

Loraine Townsend, Medical Research Council, P.O. Box 19070, Tygerberg 7505, South Africa
Email: loraine.townsend@mrc.ac.za

(Downing-Matibag & Geisinger, 2009; Simbayi, Mwaba, & Kalichman, 2006; Wechsberg et al., 2008; Weiser et al., 2006), multiple, concurrent, sexual partnering (Downing-Matibag & Geisinger; Kongnyuy & Wiysonge, 2007; Morojele et al.; Weiser et al.), transactional sex where money and/or alcohol is exchanged for sex (Simbayi et al., 2006; Weiser et al.; Wojcicki, 2002), and physical violence and sexual coercion (Zablotska et al., 2006).

A qualitative study conducted among key informants, risky drinkers, and their partners in a city and a township in Gauteng Province, South Africa, implicated the multitude of drinking venues serving relatively inexpensive alcoholic drinks, and the lack of alternative forms of recreation, in providing a context whereby alcohol consumption becomes an integral part of many men's and women's social lives (Morojele et al., 2006). Findings show that drinking among male peers of the same age fostered a sense of solidarity, and worked to reinforce a prevalent masculine ideal of excessive drinking and the pursuit of new sexual partners (Morojele et al.). This latter behavior was facilitated by the disinhibitory effect of alcohol use in being able to communicate sexual desires. Some respondents described deliberate intoxication to be able to propose sex. Alcohol was also found to increase sexual arousal, promote the need for immediate sexual gratification, and interfere with condom use among some men (Morojele et al.).

Findings from another qualitative study among patients attending a sexually transmitted infections (STI) clinic in Cape Town, South Africa were similar to Morojele et al.'s (2006); however, although both studies' informants described drinking venues as places where casual and often overt sex was common, transactional sex was mentioned only by STI patients (Simbayi et al., 2006). These informants saw alcohol as an important tool for transactional sex; it was thought that, should a woman request or accept alcohol from a man, she was willing to engage in sex with him in exchange. Findings such as these highlight the need to understand contextual norms and social and sexual practices that facilitate both risky alcohol consumption and HIV risk-taking behaviors, rather than focusing on these latter behaviors alone. Thus, the association between these risk behaviors and alcohol use has been well described in the scientific literature. However, few researchers have explored the personal perceptions among drinkers of the underlying factors that promote alcohol use and the ways in which alcohol use promotes risky sexual behaviors. In this article we explore the dynamics of social and sexual relationships in which alcohol use and risky sexual behaviors cooccur among high-risk heterosexual men—men who have multiple female sexual partners.

Method

Data were gathered from "players," i.e., men who had multiple, often younger, female sexual partners. The location

where this study was conducted is one of the poorest suburbs in South Africa, where the average household income is less than R1500 (approximately US\$150) per month (Urban Renewal Directorate, 2005), and unemployment is high (51% of the economically active population; Information and Knowledge Management Department, 2005). The majority of people (67%) live in informal shacks with limited access to piped water and sanitation (Information and Knowledge Management Department). HIV among pregnant women is considerably higher than the provincial average (33% vs. 12.6%; Shaikh et al., 2006; South African Department of Health, 2008). It has been branded as the most dangerous place in South Africa (Urban Renewal Directorate). Ethical clearance was obtained from the Health Sciences Faculty Research Ethics Committee at the University of Cape Town, South Africa.

From August to December, 2006, respondent-driven sampling (RDS; Heckathorn, 1997, 2002) was used to recruit men who reported having multiple female sexual partners into a behavioral and biological survey assessing HIV prevalence and associated risk factors. RDS was selected as an appropriate strategy for recruiting these men into the survey for a number of reasons. First, men who had multiple female sexual partners were diversely distributed throughout the general population and were thus hard to reach using conventional HIV surveillance methods. They were not captured in sufficient quantities in household surveys to make accurate conclusions about them, and traditionally used sentinel surveillance systems are designed to track infection in the general population; infection in subpopulations is not captured by these methods (World Health Organization [WHO] & Joint United Nations Program on HIV/AIDS, 2000). Second, although snowball sampling and time location sampling (TLS) have been used to recruit other hard-to-reach populations (Kendall et al., 2008), neither of these strategies would have provided representative samples of men who had multiple female sexual partners because of the influence of the choice of initial recruiters in the case of snowball sampling, and missing some venues where these men might be found in the case of TLS. RDS combines a modified form of snowball sampling with a mathematical model that weights the sample in such a way as to counteract bias introduced by the nonrandom way in which participants recruit each other (Heckathorn, 2007). Finally, authors of a recent review of 123 studies conducted internationally concluded that RDS is an effective strategy to sample high-risk, hard-to-reach, and socially networked populations for HIV biological and behavioral surveillance (Malekinejad et al., 2008).

RDS begins with a nonrandomly selected number of initial recruits who, after completing the survey, are given a set number of recruitment coupons with which to recruit friends or acquaintances from their social network to participate in the survey. After participating in the survey these

recruits are in turn given a set number of recruitment coupons with which to recruit from their social networks. This process of chain referral continues until a predetermined sample size is reached. In the quantitative study, surveyed men were 18 years or older, had sex with more than one female partner in the 3 months prior to the study, and lived, worked, or socialized in an urban, informal settlement on the outskirts of Cape Town. At least one partner was either younger than 24 years of age or 3 or more years younger than the participant. The median age of the 421 men recruited into the quantitative survey was 28 years (range: 18 to 62 years). The majority of men were never married (94.7%). Thirty-five percent had completed Grade 12, and 55.7% had completed eight or more years of school. With regard to employment, 59.7% were employed full-time, 13.8% part-time, and 26.5% were unemployed. A large proportion of men reported heavy alcohol use; 88% of men who drank alcohol reported drinking five or more alcoholic drinks on most occasions.

During quantitative data collection, two members of the research team (both men) purposively sampled and asked 20 men to participate in an in-depth interview. The researchers first approached potential participants and struck up informal conversations regarding everyday issues. In this way rapport and a level of comfort were established between participants and the researchers. The researchers then explained (a) that they would like to conduct an in-depth interview with the participants, (b) the purpose of the interview, (c) that the participants would be interviewed by both researchers, and (d) that they could speak to the researchers in the language of their choice. None of the men approached expressed any misgivings, and all agreed to be interviewed.

The researchers went through the informed consent form with each participant before being interviewed. Participants were encouraged to ask questions, and were asked to sign the consent form once the researchers were sure the participants were fully aware of its contents. Each consent form was countersigned by the researchers. Participants were then interviewed by the second author of this article, an English-speaking member of the study team. The other member of the study team acted as an interpreter during the interviews. Although all participants were sufficiently fluent in English for the interviews to be conducted mostly in English, his task was to conduct English–isiXhosa translations as needed during the interviews. Neither researcher was from the community in which the study was conducted, and thus neither was familiar with either the participants or members of the community; in this way participants' confidentiality was ensured. Although the first researcher was not of the same ethnicity as participants, the second was. Together with participant's choice of language for the interviews, the presence of a man of the same ethnicity mitigated any perceived power differentials with regard

to ethnicity that might have been present between the first researcher and participants. Interviews were conducted at a local day hospital where existing security measures ensured the safety of the interviewers and the participants. This was the same venue where the larger quantitative survey was being carried out.

A thematic question guide (TQG), which comprised previously developed broad themes, was used during the interviews. These themes were sexual behaviors, friendship networks, new sexual partner acquisition, and alcohol consumption. Within each theme, open-ended questions were used to explore, probe, and ask questions that would expand on or clarify particular topics. The interviews took approximately 1.5 hours and were audiotaped, transcribed verbatim, and cross checked with the initial recordings to ensure transcription quality. Participants were given a telephone voucher valued at R30 (±US\$3.00) for their time.

The men who agreed to be interviewed were representative of those who participated in the survey in terms of age, employment, education levels, marital status, and level of alcohol consumption. Between two and three interviews were conducted each weekend over a period of 8 weeks. This strategy ensured that the men were from different social networks because the RDS method assumes that recruitment taps into multiple social networks as it progresses over several waves of recruitment over time. To confirm this assumption, post hoc analysis of recruitment across social networks was assessed in the quantitative survey using network homophily indices on a number of key demographic and risk variables. Network homophily ranges between +1 (recruitment exclusively from within one's network) and -1 (recruitment exclusively from outside one's network), and provides an indication of recruitment between different social networks. It was found that indices of homophily ranged between -0.053 and +0.198, suggesting that recruitment across networks did indeed occur.

Data Analysis

The interview transcripts were analyzed according to a latent content analysis suggested by Graneheim and Lundman (2004). Manifest content in the form of categories that represent descriptive, explicit areas of content with little attempt at interpretation were extracted first. These were then examined for underlying meaning and situated in subthemes that cut across categories. Subthemes were then grouped into overarching themes that expressed the latent content of the transcripts. Analysis was conducted by the first two authors of this article and consensus among the study team members on the different subthemes and themes was gained through discussion and reexamination of the transcripts where necessary. The findings are presented in accordance with the themes identified.

Results

A number of themes were identified that describe how alcohol is an important part of the men's social lives and that alcohol serves as a key facilitator of multiple casual sexual relationships. The themes highlight the latent association between alcohol and transactional sex—a dynamic that has not been previously explored in our study context, and which places those who engage in these behaviors at increased risk for HIV.

On the Hunt

Without exception, all the men interviewed described a lifestyle in which alcohol was an integral part of their social lives. In close-knit friendship groups of between four and five men, they embarked on weekend activities that had an explicit agenda: going to local taverns, *shebeens* (local drinking venues), or nightclubs in the city center to drink as much alcohol as their often pooled resources would permit; have fun; and meet new sexual partners. "We are always together in this [group of] four, we hang out together and go out to drink together; we like to have fun and it's one of the ways we get chicks." Even those men who did not drink alcohol accompanied their friends to these drinking venues, where they too expected to have fun and meet new sexual partners.

Heavy Tables and Warm Pockets

Asked to describe how a typical weekend evening progressed, many of the men explained how they would go to their chosen venue and begin by buying large quantities of alcohol and spreading it over their table. This strategy was employed specifically because they thought that men who bought large quantities of alcohol were perceived by women to be wealthy; and women were only attracted to men they believed to be wealthy and generous:

So what we do if we go out to the shebeen is to make the table black . . . and the girls in that place they like to weigh which table is heavy, so it is easy for us to get girls in that way when we put a lot of alcohol on the table at once. A lot of girls can see that we are warm in our pockets [a metaphor referring to a person or group with a lot of money].

Some of the men added that it was not only the quantity of alcohol that was important in attracting the women to them, but also the quality of alcohol:

And when we drink we like to look around to see what most of the people are drinking in this place

so that we can buy something that is on a higher level than the one everybody is drinking, this will attract the ladies to us.

And you have your beer in your hand, but you wish you had storm [a popular cider] because the beer makes you feel low class in comparison to the people who are drinking storm. [The girls] don't even come to us, they just go straight to the guys who are drinking storm like them.

In this way, the overt display of large quantities of superior-quality alcohol was seen to symbolize wealth and generosity, both of which were perceived by the men to be important in attracting women.

Bees to Honey

The majority of the men described how these strategies were successful in attracting women. Some of them explained that women would circulate between the tables in the tavern or shebeen, assessing the worthiness of the men according to the quantity and quality of alcohol they were displaying on their tables. The women would then wait for an invitation to either join the table, or an offer to purchase a drink for them. Once this initial contact was made, conversations followed and the men would buy alcohol for the women:

You see the way it works, by the time you start buying beers for the lady and give her some money, that is where everything start, because she can see . . . that this one has money and he is buying a lot of alcohol. Then she decides that she will stick to you because she sees that she is getting free alcohol here, and maybe she can get some money too; then this is the opportunity for you to take her home at the end of the night.

They look at the type of guys, they look at what is on the table, and if they like what is on the table, like ciders, they will go around the table, they will pass the table a lot, waiting to be called by one of the guys.

Some of the men described how alcohol as currency was provided for their friends who did not drink. In this way, all men in the peer group who had set out with the intention to pursue sexual partners were able to do so.

Easy Girls and Hard Girls

For many of the men, the conversations entailed an implicit understanding that they would eventually leave together

and have sex. Although it was evident that many women were complicit in the understanding, one man described how some of the younger men in the shebeen would “grab any girl that is in front of them even if there was no agreement.” Some of the men spoke of not wanting to waste their time or money on women who were not complicit in this understanding:

There is another group of ladies that you know just by looking at them that they will drink and disappear. First we must bring her close and let her see what is going on here, before we can spend and waste our money on her.

We know what these ladies want, you see, money and alcohol, and we provide, and sometimes—if not most of the time—we provide with intentions to sleep with them.

Clearly this was not the case with all women, because some were there to drink and enjoy themselves without having to associate with the men there. The men described what they termed “easy girls” and “hard girls”:

Sometimes you meet easy girls and hard girls. Sometimes you can even tell by having a conversation that this girl you are taking home, and you talk to another girl and you know that she will give you hard time, which is when you decide to let go of her.

The easy girls were the ones that men immediately knew would be willing to leave with them at the end of the evening, and the hard girls were those whom they thought would not do so.

“Taking Care of Business” Versus Love

To satisfy what seemed to be a desire for immediate sexual gratification, many of the men expected that they would have sex with the women at the end of the evening, if not during the course of the evening. For some, this meant engaging in sex within hours of meeting the women, in any convenient place. One of the men described how he and his friends used a nearby public bathroom to have sex with the women they had met during the evening, using chairs for a make-shift bed. Another man spoke of how he saw many men hooking up with girls at the shebeen. By hooking up, he was referring to having successfully negotiated having sex with the girl. Asked where these men went to have sex, he explained, “Sometimes at the back yard of the shebeen.”

Some of the men described how their intentions when going to the shebeen on a weekend did not necessarily

include meeting new sexual partners or engaging in transactional sex; however, two of the men suggested that if they were approached by a woman to buy her a beer they would expect to end the evening by having sex with her. Both these men saw these sexual encounters as “taking care of business,” with no strings attached:

Just like me, I have a wife and my children and I do not have girls, but at the shebeen I hook up with her and take care of business. Taking care of business is to get what you want from her and she got what she wanted from you.

Conversely, another man described his approaches to women he met in romantic terms, describing “seeing love,” and of women “falling for” him:

I come in to buy my beers, that is my intention, but it happens that she comes and ask for a beer and I buy her and then I see something more. But what I am doing is not decent, but the case is that the girl is in front of me and I see something more. But it is not decent.

When asked by the interviewer to clarify what he meant by “something more,” this man explained, “I see love. When you see something else, you see love and you become interested. . . . Eventually she will fall for you, and she will go with you.”

Some men seemed quite realistic about the businesslike nature of these transactional sexual encounters, perceiving that the transaction was mutually understood and beneficial. Others recognized that their involvement in transactional relationships was “not decent,” and by couching them in romantic terms, might have been attempting to legitimize their actions.

A Dangerous Cocktail: Alcohol and Nonuse or Misuse of Condoms

Alcohol and the need for sexual gratification combined to interfere with condom use. Some men spoke about the effect that alcohol had on their ability to use condoms and to use them correctly:

You see this thing with the virus, yes sure, it is scary, you know, I am really scared of it. But then I look at the chick, and if she is cute, you normally forget about it [referring to the condom] when you are in a hurry and drunk.

Because sometimes you go to shebeen and you do have a condom, but because you are drunk, you try

to wear it and it is not worn properly, but you will not fix it. You will have sex with it just like that. Because when you are drunk and horny, you do not think.

Although these men were aware of the risk for HIV that not using a condom with casual partners presents, haste and overconsumption of alcohol overrode this awareness, or interfered with their ability to wear a condom properly.

Discussion

From this study's findings we are able to provide an in-depth examination of the role that alcohol plays as a currency in multiple, casual, transactional sexual relationships among men in a periurban setting on the outskirts of Cape Town.

Men in this study socialized with friends at shebeens, bars, and taverns, where the display of large quantities of alcohol and the consumption thereof formed an integral part of their social lives, and became a core facilitator in sexual relationship development. Findings from studies in other periurban contexts have identified similar venues where men commonly meet to socialize (Weir et al., 2003; Weir, Morroni, Coetzee, Spencer, & Boerma, 2002), and where extensive and diverse social networks, characterized by high rates of new sexual partner formation, concurrency, and low condom use were common. The absence of alternative forms of leisure activity and the paucity of recreational facilities available in the study setting is common in urban and periurban communities in South Africa (Morojele et al., 2006). However, in contexts where multiple, concurrent partnering is sanctioned and promoted (Morojele et al.), and the use of condoms is still eschewed by many men (Chopra et al., 2009), it might be that alcohol is used as a convenient rationalization for risky sex for some of these men. For others it would seem that intentions to use condoms were present, but that alcohol use interfered with (correct) condom use.

The men described close-knit groups of peers who shared this lifestyle characterized by excessive, binge drinking and the pursuit of women sexual partners over weekends (see Ragnarsson, Townsend, Thorson, Chopra, & Ekström, 2009). Their way of life strongly supported a masculine ideal that not only condoned and promoted heavy drinking, but also the formation of multiple sexual partnerships. This lifestyle was also reported in Morojele's study in Gauteng Province (Morojele et al., 2006); however, central to the social dynamics depicted here and not in the Gauteng study was the role that alcohol played as a currency in transactional sex.

Although findings from many studies in sub-Saharan Africa have described transactional sex as a means for women to survive in a context of economic need, others

have suggested that women engage in transactional sex not from economic need but as a means to acquire material goods such as cell phones, new clothes, and so forth (Dunkle et al., 2007; Hunter, 2007; Leclerc-Madlala, 2003). Many young women are becoming aware of their exploitation by men in sexual relationships; transactional sex accompanied by multiple sexual partnering becomes their way of (economic) exploitation of men, resulting in feelings of power (Leclerc-Madlala; Silberschmidt & Rasch, 2001). Indeed, it has been suggested that women deliberately develop strategic sexual relationships with multiple sexual partners who can provide them modern material goods in "pursuit of modernity" and becoming a "modern girl" (Hawkins, Mussa, & Abuxahama, 2005; Kaufman & Stavrou, 2004; Leclerc-Madlala; Longfield, Glick, Waithaka, & Berman, 2004; Silberschmidt & Rasch). This might well be what men in this study were experiencing when they suggested that women deliberately targeted them for alcohol and/or money, and were complicit in the understanding that this would eventually lead to sexual relations. However, the informants' conception of "hard girls" might constitute another side of the empowered woman: one who feels she has the power to reject sexual advances by men.

Despite women's empowerment, their risk for HIV was not mitigated, as it is still likely that their agency stopped at the point of the sexual act. In accepting alcohol and/or money for sexual exchange, the "paying" partner gained sexual leverage and the right to guard and use his "investment" (Wood & Jewkes, 2001) in whatever way he chose. Thus, in sexual relationships characterized by exchange, a woman was likely to be signing away her rights and power to negotiate the terms on which sex took place between her and her partner, including condom use (Kaufman & Stavrou, 2004; Luke, 2003; Silberschmidt & Rasch, 2001; Wojcicki & Malala, 2001). Findings from these last-cited studies have done much to elaborate on women's perspectives of condom negotiation; future studies should explore the dynamics of condom use negotiation among men who engage in transactional sex, especially when alcohol is involved.

The findings from this study provide us with an opportunity to build on an existing conceptual framework suggested by Morojele and colleagues (2006), through which they propose a culture-specific interrelationship between alcohol use and risky sexual practices (see Figure 1). Their model is based on findings from their study among men and women key informants, risky drinkers, and their partners in a city and a township in Gauteng Province, South Africa. In augmenting Morojele's model, we trace the potential pathways by which alcohol consumption and transactional sex were linked to sexual risk behaviors in our study context. An adaptation of Morojele's model is reproduced in Figure 1, and our elaborations and pathways are depicted

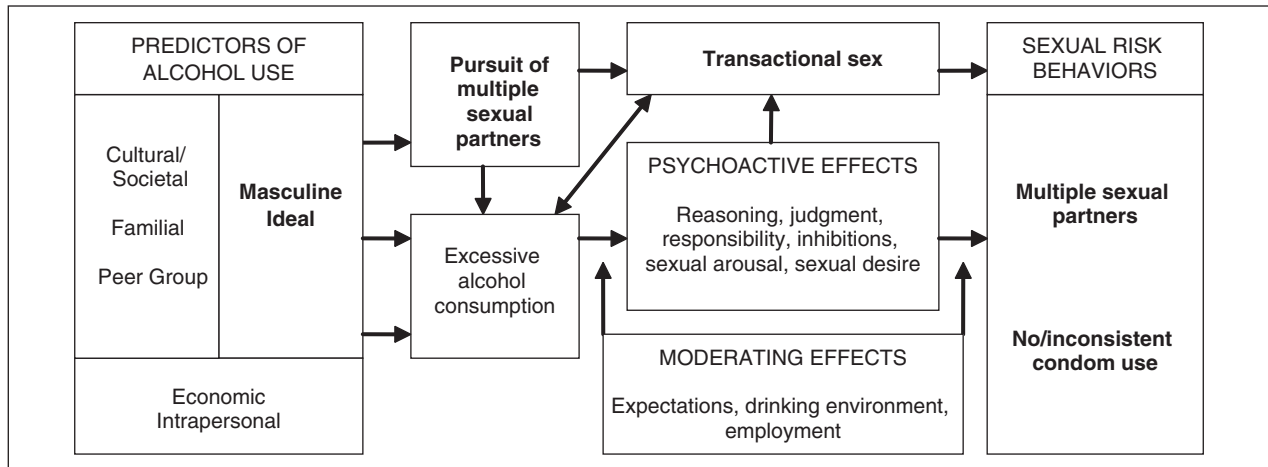


Figure 1. Potential pathways by which alcohol use and transactional sex are linked to sexual risk behavior
Adapted from Morojele et al., 2006, p. 225.

as bolded text within the boxes. In suggesting these additions to the conceptual framework, we would stress from the outset that its applicability is limited to men.

In the model proposed by Morojele and colleagues (2006), they begin by proposing a number of fundamental reasons for heavy alcohol consumption, also referred to as distal predictors of alcohol-related sexual risk behaviors. These distal predictors are (a) economic predictors (for example, unemployed men might drink to cope with the effects of living in conditions of poverty, or employed and wealthier men might drink simply because they can afford to); (b) exposure to societal, cultural, community, familial, and peer-group norms (e.g., norms related to a masculine ideal that promotes heavy drinking and the pursuit of multiple sexual partners, and easy access to alcohol); and (c) intrapersonal factors (e.g., having had a history of trauma and violence). The next link in the model is between alcohol use and the psychoactive effects of alcohol that in turn operate to exacerbate risky sexual behavior. A number of moderating factors that strengthen or weaken the association between alcohol use and the psychoactive effects of alcohol, and between the psychoactive effects of alcohol and risky sexual behavior, are suggested by the model. These moderating factors include the economic, societal/cultural, and community factors described earlier; the drinking environment; and proximal, individual factors and expectancies. In the latter case, for example, people's expectations that alcohol use will increase sexual arousal and desire, or that alcohol use makes one less inhibited in proposing sex, will cause them to drink.

We have elaborated on Morojele and colleagues' model in the following ways. First, their model subsumes notions of masculine ideal(s) under societal, cultural, community, familial, and peer-group factors as distal predictors of

alcohol-related risky sexual behavior. Without exception, the men in our study reported alcohol consumption and the pursuit of (multiple) sexual partners as central to their weekend socializing activities. Evidently these two behaviors formed a part of their masculine ideal, and we propose that these context-specific masculine ideals found in our study deserve greater visibility at this distal level. Second, although Morojele and colleagues' model ignores the influence of transaction in sexual relationships, our findings suggest that transactional sex plays a pivotal role in both excessive alcohol use and multiple sexual partnering. Third, we suggest specific risk behaviors under the model's broad label of "Sexual Risk Behavior" that has practical implications for HIV interventions.

At the distal level, our findings confirm that parts of a dominant masculine ideal in the study context were having multiple female sexual partners and the ability to consume large quantities of alcohol. One way to satisfy the one part of this masculine ideal (i.e., to have multiple sexual partners) was through transactional sex. Many men in our study explained how they deliberately used alcohol in their strategy to attract women to them, and then as a currency in transacting for sex. The other part of the masculine ideal, excessive alcohol consumption, operated at three interwoven levels that increased risk behavior. First, alcohol use operated bidirectionally in its relationship with transactional sex. It provided the person seeking out new sexual partners with decreased inhibitions and increased confidence in proposing sex either directly or moderated by expectancies. Additionally, alcohol was used as an important currency in the transaction for sex. Second, we found that alcohol use promoted no, inconsistent, or incorrect condom use, despite knowledge of the associated risk for HIV this posed. Likewise, findings from other studies referred to earlier have

shown that within transactional sexual relationships the balance of power lies with the “paying” (male) partner in determining the conditions of sex, specifically whether condoms are used. Thus, our findings suggest that at the proximal, individual level, condom use is inextricably linked to both transactional sex and excessive alcohol use, and both of these behaviors increase the risk of HIV infection and transmission among those involved in the (multiple) sexual transactions.

Although this study was based on the perceptions of a small sample of high-risk heterosexual men, its strength lies in the in-depth examination of the central role that alcohol plays in the social lives of men and women in this context, as well as in transactional sexual relationships. An additional strength is in the focus of the proposed conceptual framework, which narrows attention to two aspects of a context-specific masculine ideal: multiple sexual partners and excessive alcohol use. Discrete behaviors such as reducing the number of sexual partners one has and/or adopting a more responsible use of alcohol are arguably amenable to intervention and adoption as a starting point in addressing the broader, deeply entrenched masculine ideals that work to (re)confirm men’s power in relation to women (Jewkes, Levin, & Penn-Kekaka, 2002).

Conclusion

Findings from this study and the proposed conceptual framework have important implications for the prevention of risky sexual behavior among men who drink alcohol heavily and episodically, and their casual sexual partners. HIV prevention interventions need to place a greater emphasis on addressing the norms that underlie and behaviors that facilitate risky sexual behaviors among those men who drink alcohol at excessive levels—specifically those norms that are integral to perceptions of a dominant masculine ideal in informal urban settings. Our conceptual framework suggests two normative, discrete behaviors within the context-specific masculine ideal where interventions might begin to do this. Additionally, given the close-knit relationships within peer groups and the strong probability of peer pressure within such groups, interventions conducted among groups of peers might be more effective than those that focus on individuals alone. Individuals might be unable to resist pressure to conform to dominant male norms promoting multiple sexual relationships characterized by exchange and heavy alcohol use when interacting with their peers. Furthermore, the implicit peer pressure that might exist for men to engage in transactional sex might be amenable to the influence of popular opinion leader interventions (Kelly, 2004). Such interventions employ popular and respected men who are recruited and trained to influence others in their social networks through visible (positive)

example and dialogue. Interventions that address women’s dependency on transactional sex as a means of income and/or desired material goods are evidently needed to enable the women to resist sexual relationships characterized by exchange. Here, micro-finance interventions for women have shown some promise and could be promoted (Pronyk et al., 2006). Venue-based interventions that target patrons within shebeens and taverns might be more effective than nonvenue, community-based interventions. Finally, it is evident that future research should gather the perspectives of women who frequent the drinking venues and engage in transactional sexual relationships described here. Results from such research might then augment the expanded conceptual model presented here.

Authors’ Note

Portions of this article were presented at the 9th International AIDS Impact Conference, September 24, 2009, in Gaborone, Botswana.

Declaration of Conflicting Interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research and/or authorship of this article: The second author received support from the Swedish Research Council, Swedish International Development Agency (Sida)/SAREC, and the National Research Foundation (NRF), South Africa.

References

- Chopra, M., Townsend, L., Johnston, L. G., Mathews, C., Tomlinson, M., O’Bra, H., & Kendall, C. (2009). Estimating HIV prevalence and risk behaviors among high-risk heterosexual men with multiple sex partners: Use of respondent-driven sampling. *Journal of Acquired Immune Deficiency Syndrome*, 51, 70-75. doi:10.1097/QAI.0b013e31819907de
- Downing-Matibag, T., & Geisinger, B. (2009). Hooking up and sexual risk taking among college students: A health belief model perspective. *Qualitative Health Research*, 19, 1196-1209. doi:10.1177/1049732309344206
- Dunkle, K. L., Jewkes, R., Nduna, M., Jama, N., Levin, J., Sikweyiya, Y., & Koss, M. P. (2007). Transactional sex with casual and main partners among young South African men in the rural Eastern Cape: Prevalence, predictors, and associations with gender-based violence. *Social Science & Medicine*, 65, 1235-1248. doi:10.1016/j.socscimed.2007.04.029
- Fisher, J. C., Bang, H., & Kapiga, H. (2007). The association between HIV infection and alcohol use: A systematic review and meta-analysis of African studies. *Sexually Transmitted Infections*, 34, 856-862. doi:10.1097/OLQ.0b013e318067b4fd
- Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: Concepts, procedures and

- measures to achieve trustworthiness. *Nurse Education Today*, 24, 105-112. doi:10.1016/j.nedt.2003.10.001
- Hawkins, K., Mussa, F., & Abuxahama, S. (2005). "Milking the Cow." *Young women's constructions of identity, gender, power and risk in transactional and cross-generational sexual relationships: Maputo, Mozambique*. Swansea, UK: Centre for Development Studies.
- Heckathorn, D. (1997). Respondent driven sampling: A new approach to the study of hidden populations. *Social Problems*, 44, 174-199. Retrieved from <http://www.jstor.org/stable/3096941>
- Heckathorn, D. (2002). Respondent driven sampling II: Deriving valid population estimates from chain-referral samples of hidden populations. *Social Problems*, 49, 11-34. Retrieved from <http://www.jstor.org/stable/3097114>
- Heckathorn, D. D. (2007). Extensions of respondent-driven sampling: Analyzing continuous variables and controlling for differential recruitment. *Sociological Methodology*, 37, 151-207. doi:10.1111/j.1467-9531.2007.00188.x
- Hunter, M. (2007). The changing political economy of sex in South Africa: The significance of unemployment and inequalities to the scale of the AIDS pandemic. *Social Science & Medicine*, 64, 689-700. doi:10.1016/j.socscimed.2006.09.015
- Information and Knowledge Management Department. (2005). *A population profile of Khayelitsha. Socio-economic information from the 2001 census*. Retrieved from http://www.capetown.gov.za/en/stats/CityReports/Documents/Population%20Profiles/A_Population_Profile_of_Khayelitsha_1052006142120_359.pdf
- Jewkes, R., Levin, J., & Penn-Kekaka, L. (2002). Risk factors for domestic violence: Findings from a South African cross-sectional study. *Social Science & Medicine*, 55, 1603-1617. doi:10.1016/S0277-9536(01)00294-5
- Joint United Nations Program on HIV/AIDS. (2008). *Report on the global AIDS epidemic*. Geneva, Switzerland: Author.
- Kalichman, S. C., Simbayi, L. C., Kaufman, M., Cain, D., & Jooste, S. (2007). Alcohol use and sexual risks for HIV/AIDS in sub-Saharan Africa: A systematic review of empirical findings. *Prevention Science*, 8, 141-151. doi:10.1007/s11121-006-0061-2
- Kaufman, C. E., & Stavrou, S. E. (2004). Bus fare please: The economics of sex and gifts among young people in urban South Africa. *Culture, Health & Sexuality* 6, 377-391. Retrieved from <http://www.jstor.org/stable/4005305>
- Kelly, J. (2004). Popular opinion leaders and HIV peer education: Resolving discrepant findings, and implications for the implementation of effective community programmes. *AIDS Care*, 16, 139-150. doi:10.1080/09540120410001640986
- Kendall, C., Kerr, L. R. F. S., Gondim, R. C., Werneck, G. L., Macena, R. H. M., Pontes, M. K., & McFarland, W. (2008). An empirical comparison of respondent-driven sampling, time location sampling, and snowball sampling for behavioral surveillance in men who have sex with men, Fortaleza, Brazil. *AIDS & Behavior*, 12, S97-S104. doi:10.1007/s10461-008-9390-4
- Kongnyuy, E., & Wiysonge, C. S. (2007). Alcohol use and extra-marital sex among men in Cameroon. *BMC International Health & Human Rights*, 6. doi:10.1186/1472-698X-7-6
- Leclerc-Madlala, S. (2003). Transactional sex and the pursuit of modernity. *Social Dynamics*, 29, 213-233. doi:10.1080/02533950308628681
- Longfield, K., Glick, A., Waithaka, M., & Berman, J. (2004). Relationships between older men and younger women: Implications for STIs/HIV in Kenya. *Studies in Family Planning*, 35, 125-134. Retrieved from <http://www.jstor.org/stable/3181140>
- Luke, N. (2003). Age and economic asymmetries in the sexual relationships of adolescent girls in sub-Saharan Africa. *Studies in Family Planning*, 34, 67-86. Retrieved from <http://www.jstor.org/stable/3181180>
- Malekinejad, M., Johnston, J. G., Kendall, C., Kerr, L. R. F. S., Rifkin, M. R., & Rutherford, G. W. (2008). Using respondent-driven sampling methodology for HIV biological and behavioral surveillance in international settings: A systematic review. *AIDS & Behavior*, 12, S105-S130. doi:10.1007/s10461-008-9421-1
- Morojele, N. K., Kachieng'a, M. A., Mokoko, E., Nkoko, M. A., Parry, C. D. H., Nkowane, A.M., . . . Saxena, S. (2006). Alcohol use and sexual behaviour among risky drinkers and bar and shebeen patrons in Gauteng Province, South Africa. *Social Science & Medicine*, 62, 217-227. doi:10.1016/j.socscimed.2005.05.031
- Parry, C. D. (2005). South Africa: Alcohol today. *Addiction*, 100, 426-429. doi:10.1111/j.1360-0443.2005.01015.x
- Pronyk, P. M., Hargreaves, J. R., Kim, J. C., Morison, L., Phetla, G., Watts, C., . . . Porter, J. D. H. (2006). Effect of a structural intervention for the prevention of intimate-partner violence and HIV in rural South Africa: A cluster randomized trial. *Lancet*, 368, 1973-1983. doi:10.1016/S0140-6736(06)69744-4
- Ragnarsson, A., Townsend, L., Thorson, A., Chopra, M., & Ekström, A. M. (2009). Social networks and concurrent sexual relationships—A qualitative study among men in an urban South African community. *AIDS Care*, 21, 1253-1258. doi:10.1080/09540120902814361
- Schneider, M., Norman, R., Parry, C., Bradshaw, D., Plüddemann, A., & the South African Comparative Risk Assessment Collaborating Group. (2007). Estimating the burden of disease attributable to alcohol use in South Africa in 2000. *South African Medical Journal*, 97, 664-672. Retrieved from <http://www2.samj.org.za/index.php/samj/article/viewFile/658/155>
- Shaikh, N., Abdullah, F., Lombard, C. J., Smit, L., Bradshaw, D., & Makubalo, L. (2006). Masking through averages—Intraprovincial heterogeneity in HIV prevalence within the Western Cape. *South African Medical Journal*, 96, 538-543.

- Retrieved from <http://www2.samj.org.za/index.php/samj/article/viewFile/1136/582>
- Silberschmidt, M., & Rasch, V. (2001). Adolescent girls, illegal abortions and "sugar-daddies" in Dar es Salaam: Vulnerable victims and active social agents. *Social Science & Medicine*, 52, 1815-1826. doi:10.1016/S0277-9536(00)00299-9
- Simbayi, L. C., Mwaba, K., & Kalichman, S. C. (2006). Perceptions of the combination of HIV/AIDS and alcohol as a risk factor among STI clinic attenders in South Africa: Implications for HIV prevention. *Social Behavior and Personality*, 34, 535-544. doi:10.2224/sbp.2006.34.5.535
- South African Department of Health. (1998). *South African demographic and health survey*. Pretoria, South Africa: Author.
- South African Department of Health. (2008). *The national HIV and syphilis prevalence survey South Africa 2007*. Pretoria, South Africa: Author.
- Urban Renewal Directorate. (2005). *Lessons learnt from Khayelitsha business development*. Cape Town, South Africa: Author.
- Wechsberg, W. M., Luseno, W. K., Karg, R. S., Young, S., Rodman, N., Myers, B., & Parry, C. D. H. (2008). Alcohol, cannabis, and methamphetamine use and other risk behaviors among Black and coloured South African women: A small randomized trial in the Western Cape. *International Journal of Drug Policy*, 19, 130-139. doi:10.1016/j.drugpo.2007.11.018
- Weir, S., Pailman, C., Mahlalela, X., Coetzee, N., Meidant, F., & Boerma, J. T. (2003). From people to places: Focusing AIDS prevention efforts where it matters most. *AIDS*, 17, 895-903. Retrieved from http://journals.lww.com/aidsonline/Abstract/2003/04110/From_people_to_places_focusing_AIDS_prevention.15.aspx
- Weir, S. S., Morroni, C., Coetzee, N., Spencer, J., & Boerma, J. T. (2002). A pilot study of a rapid assessment method to identify places for AIDS prevention in Cape Town, South Africa. *Sexually Transmitted Infections*, 78 (Suppl. 1), 106-113. doi:10.1136/sti.78.suppl_1.i106
- Weiser, S. D., Leiter, K., Heisler, M., McFarland, W., Percyde Korte, F., DeMonner, S. M., . . . Bangsberg, D. R. (2006). A population-based study on alcohol and high-risk sexual behaviors in Botswana. *PloS Medicine*, 3, e392. doi:10.1371/journal.pmed.0030392
- Wojcicki, J. M. (2002). Commercial sex work or *ukuphanda*? Sex-for-money exchange in Soweto and Hammanskraal area, South Africa. *Culture, Medicine and Psychiatry*, 26, 339-370. doi:10.1023/A:1021291922026
- Wojcicki, J. M., & Malala, J. (2001). Condom use, power and HIV/AIDS risk: Sex-workers bargain for survival in Hillbrow/Joubert Park/Berea, Johannesburg. *Social Science & Medicine*, 53, 99-121. doi:10.1016/S0277-9536(00)00315-4
- Wood, K., & Jewkes, R. (2001). Dangerous love: Reflections on violence among Xhosa township youth. In R. Morrell (Ed.), *Changing men in South Africa* (pp. 317-336). Pietermaritzburg, South Africa: University of Natal Press.
- World Health Organization, & Joint United Nations Program on HIV/AIDS. (2000). *Guidelines for second generation HIV surveillance*. Geneva, Switzerland: Author.
- Zablotska, I. B., Gray, R. H., Serwadda, D., Nalugoda, F., Kigozi, G., Sewankambo, N., . . . Wawer, M. (2006). Alcohol use before sex and HIV acquisition: A longitudinal study in Rakai, Uganda. *AIDS*, 20, 1191-1196. doi:10.1097/01.aids.0000226960.25589.72

Bios

Loraine Townsend, MA, is a senior scientist in the Health Systems Research Unit at the Medical Research Council, Cape Town, South Africa, and PhD student in the Department of Psychiatry and Mental Health at the University of Cape Town, Cape Town, South Africa.

Anders Ragnarsson, MPH, is a PhD student in the Department of Public Health Sciences, Division of Global Health (IHCAR), at the Karolinska Institutet, Stockholm, Sweden.

Catherine Mathews, PhD, is a senior specialist scientist in the Health Systems Research Council at the Medical Research Council, Cape Town, South Africa, and associate professor in the Department of Public Health and Family Medicine at the University of Cape Town, Cape Town, South Africa.

Lisa Grazina Johnston, PhD, is an independent consultant and adjunct faculty member at the Tulane University School of Public Health & Tropical Medicine, New Orleans, Louisiana, USA.

Anna Mia Ekström, PhD, is an associate professor in the Department of Public Health Sciences, Division of Global Health (IHCAR), Karolinska Institutet, Stockholm, Sweden.

Anna Thorson, PhD, is an associate professor in the Department of Public Health Sciences, Division of Global Health (IHCAR), Karolinska Institutet, Stockholm, Sweden.

Mickey Chopra, PhD, is head of Health at the United Nations Children's Fund, New York, New York, USA.

A systematic review of behavioural interventions to prevent HIV infection and transmission among heterosexual, adult men in low- and middle-income countries.

Paper overview

This analysis used findings from studies that reported on behavioural interventions conducted among heterosexual males residing in low- and middle-income countries. Nineteen studies reporting on interventions in 12 countries met the review criteria. Condom use interventions were most effective; alcohol use interventions and those targeting multiple sexual partners the least effective; and large, community-based interventions the most acceptable to address intimate partner violence and gender-based violence.

Contribution to the thesis and novelty

This paper addresses the seventh objective of the thesis: to determine what gender-specific HIV prevention and risk reduction interventions have been implemented and evaluated among heterosexual adult males, in low- and middle-income countries. It is the only known review of HIV intervention studies that focus on heterosexual men in low- and middle-income countries. Other reviews to date have focused on heterosexual populations (male and female) in the United States only and among specific ethnic groups, and on women in low- and middle countries. The review provides an invaluable, accessible resource for community-based organisations, HIV/AIDS service and prevention providers who are at the coal-face of HIV prevention and service provision.

Contribution of candidate

The candidate was responsible for the conceptualization of the review; sourced all studies; assessed them for inclusion in the review; and data extraction and evaluation. The first draft of the paper was written by the candidate with comments offered by the co-authors.

Publication status

Submitted for review at *Prevention Science* on 16th August 2010

Review of behavioural interventions for heterosexual men

A systematic review of behavioural interventions to prevent HIV infection and transmission among heterosexual, adult men in low- and middle-income countries

Loraine Townsend, Medical Research Council, Cape Town, South Africa

Catherine Mathews, Medical Research Council and University of Cape Town, Cape Town, South Africa

Yanga Zembe, Medical Research Council, Cape Town, South Africa

Corresponding author:

Loraine Townsend

Health Systems Research Unit

Medical Research Council

P.O. Box 19070

Tygerberg

7505

Telephone: +27 21 715 4340

e-mail: loraine.townsend@mrc.ac.za

INTRODUCTION

For every two people who started HIV treatment in 2007, five were newly infected with the virus globally (UNAIDS, 2009a). In 2008 the world saw 2.7 million people becoming newly infected with HIV, the majority of which occurred in the low- and middle-income countries (LMICs) of sub-Saharan Africa (1.9 million) (UNAIDS, 2009a). If the global community has any chance of reversing the global HIV epidemic, a concerted effort needs to be made to stop all new infections, or at most, decrease them sharply (Global HIV Prevention Working Group, 2007).

An unprecedented international political will and financial commitment has been amassed for the global fight against HIV and AIDS. International commitment rose from US\$1.6 billion to U.S.\$13.8 billion between 2001 and 2008, much of it going to resource-constrained, LMICs (Izazola-Licea, Wiegelman, Arán, Guthrie, De Lay & Avila-Figueroa, 2009). This trajectory saw a concomitant, significant increase in HIV treatment in these regions: 38% between 2007 and 2008, and a 10-fold increase from 2003 to 2008 (UNAIDS, 2009a). However, soon after these positive advances in treatment, funding began to decrease as “donor fatigue” set in (Médecins Sans Frontières, 2010), and the global economic crisis began to take its toll (UNAIDS, 2009b). With dwindling resources available to continue, let alone sustain HIV treatment over the next decades, prevention of new infections needs to move to the forefront in the fight against HIV and AIDS. “By delivering comprehensive HIV prevention to those who need it – the right interventions focused on the right people at the right scale – half of all new infections projected to occur by 2015 could be averted” (Global HIV Prevention Working Group, 2007: p.1).

However, while it is vitally important not to channel resources away from treatment, the challenge in the current economic crisis is to allocate HIV prevention resources appropriately and thus get the best possible impact from any investment in HIV prevention (UNAIDS, 2009c). Another challenge is to amass reliable evidence-based information about behavioural prevention efforts that have had an effect, or not. Prevention intervention practitioners and policy makers could use this information to make informed decisions about implementation of behavioural prevention interventions that have been shown to work, and relinquish or modify those that have had limited or no effect. More importantly, resource-constrained LMICs need to invest the limited prevention resources on behaviours that are driving the epidemic, and among the people who are engaging in those behaviours. For many LMICs, where HIV prevalence is highest (for example, in sub-Saharan Africa where 71% of all new HIV infections occurred in 2008 (UNAIDS, 2009a)), one such group of people is heterosexual men.

More than ten years ago, Exner and colleagues published a review of risk reduction interventions conducted among heterosexual men in the United States (Exner, Gardos, Seal & Ehrhardt, 1999). At the time, Exner noted the strong focus of risk-reduction on heterosexual women and the limited focus on heterosexual men, suggesting they comprise a “forgotten group”. These authors argued that “heterosexually active men be included in strategic efforts to reduce heterosexual transmission because sexual behavior is dyadic and men are the [sexual] partners of women” (Exner et al., 1999: p. 348). A recent systematic review of behaviour change interventions among women living in low- and middle-income countries was motivated by the complete lack of a summary of behavioural intervention for HIV prevention in the developing world (McCoy, Kangwende & Padian, 2010). Furthermore, the review

Review of behavioural interventions for heterosexual men

literature to date has had a propensity for complex systematic and meta-analytic analyses that are arguably inaccessible to those who need it most: community-based organizations, HIV/AIDS service and prevention providers (Kelly et al., 2000) who are on the front line of HIV prevention and service provision.

This paper aims to fill important gaps in the review literature by providing a widely-accessible, systematic review and synthesis of behavioural interventions among a forgotten group in high HIV-burden countries: heterosexual men in low- and middle-income countries.

METHOD

Search Strategy

We searched the following databases for articles reporting on a HIV/AIDS and/or STI, behavioural prevention interventions that fit the review criteria: PubMed, PsycInfo, PsycArticles, SocINDEX, Academic Search Premier, ScienceDirect, The Centers for Disease Control and Prevention's (CDC) HIV/AIDS Prevention Research Synthesis Project's compendium of HIV Prevention Interventions with Evidence of Effectiveness (Centre for Disease Control and Prevention, 2001); and the Cochrane HIV/AIDS Group reviews and protocols. Keywords for the search and permutations thereof included HIV/AIDS; sexually transmitted infections / STI / sexually transmitted diseases / STD; prevention; intervention; adults; men / male; control; comparison; trial. The Boolean phrase "not" was included where possible to exclude articles reporting on studies conducted among men who have sex with men (MSM) / gay / transgender; women / females; and youth / adolescents / children. We hand-searched the reference lists of all sourced and eligible articles. We contacted study authors when clarification was needed to decide eligibility of studies for the review, for example, the composition of samples with respect to sexual orientation and/or gender.

Inclusion and exclusion criteria

The review includes studies that evaluated behavioural prevention interventions aiming to reduce HIV and/or STI risk behaviours among heterosexual adult males residing in LMICs globally, according to the World Bank income criteria (World Bank, 2010). The review includes studies that: 1) included heterosexual males aged 18+ years; or a majority ($\geq 75\%$) of 18+ year old males if younger aged males were included in the sample; or a majority ($\geq 75\%$) of males if females were included in the sample; 2) were conducted in LMICs; 3) that evaluated an intervention group / condition relative to a control or comparison group / condition and included between-group analysis of the data; 4) reported outcome data on at least one HIV-related risk behaviour and 5) were published in English-language, peer-reviewed journals from January 2001 to May 2010.

We excluded studies that did not report intervention outcome data separately for gender or control for gender in the analysis if $>25\%$ females were included in the sample. Similarly, we excluded studies that had $\geq 15\%$ of men who reported having male sexual partners within their sample of males.

Data extraction

We extracted the following information from each article: sample characteristics, intervention components, assessment time points and outcomes (presented in Table 1). Studies were grouped according to the countries in which the interventions were implemented.

Review of behavioural interventions for heterosexual men

The behavioural outcomes are reported in Table 1. using symbols to represent significant increases [↑], decreases [↓] or no differences between intervention groups [ns]. We included symbols for those outcomes that suggested an increase [↑ns] or decrease [↓ns] in behavioural outcome, i.e. where $p < 0.10$ was reported.

Evaluation

Each of the studies was evaluated and rated using the quality assessment tool for quantitative studies developed by the Effective Public Health Practice Project (EPHPP) (Effective Public Health Practice Project, 2009). This tool provides pertinent questions with which to evaluate studies in the following domains: 1) Selection bias was assessed by means of two questions about the representativeness of the sample to the target population and refusals to participate in the intervention. 2) Study designs considered strong include randomized controlled trials and controlled clinical trials. Those rated moderate are cohort analytic (two group pre- and post-intervention assessment), case-control, cohort (one group pre- and post-intervention assessment) and interrupted time series studies. Any other form of study design is considered “weak” according to EPHPP. 3) Confounders were identified through questions about differences between groups prior to the intervention and how many confounders were controlled. 4) Blinding assessed whether outcome assessor/s were aware of the intervention or exposure status of participants and/or whether participants were aware of the research question. 5) Data collection methods were evaluated according to whether the validity and/or reliability was reported. 6) Whether and what percentage of participants withdrew and/or dropped out of the intervention or assessments informed the domain: withdrawal and dropouts. 7) Intervention integrity enquired about the percentage of participants who received the intervention, whether the consistency of the intervention was measured and whether participants may have received an unintended or co-intervention (i.e., contamination). 8) Analyses were assessed by providing information about the unit of allocation, the unit of analysis, the appropriateness of statistical methods and whether the analysis followed an intention-to-treat method.

With the aid of a quality assessment tool dictionary (available from <http://www.ehphp.ca/Tools.html>), ratings (strong, moderate, weak) were allocated to studies for each of the first six domains from which a global rating was then obtained. The global ratings are “strong” if none of the domains were rated “weak”; “moderate” if one of the domains was rated as “weak”; and “weak” if two or more of the domains were rated “weak”. Table 1 provides the EPHPP-derived global rating, the domain identified as “weak” where appropriate, and limitations of the respective interventions / studies.

INSERT TABLE 1 APROXIMATELY HERE

RESULTS

Overview

The review identified 19 HIV/AIDS/STI studies that fit the inclusion criteria. Most of studies were conducted in South Africa (n=6), with two each in Uganda and Thailand, and one in each of Angola, Brazil, Bulgaria, India, Nigeria, the Philippines, Russia, Ukraine and Zimbabwe. The majority reported on community-based interventions (n=9) where participants were drawn from the general population. Specifically, people residing in peri-urban, urban and rural communities in Nigeria, South Africa, Zimbabwe, Uganda and the Philippines (Exner et al., 2009; Gregson et al., 2007; Jewkes et al., 2008; Kajubi et al., 2005; Kamali et al., 2003; Morisky et al., 2004), townships in South Africa (Kalichman et al., 2008 & 2009), and a settlement in Bulgaria (Kelly et al., 2006). Six studies reported on interventions conducted with people who were alcohol or drug users, or in drug treatment programmes in Ukraine, South Africa, Thailand, Brazil and Russia (Booth et al., 2009; Kalichman et al., 2007; Latkin et al., 2009; Pechansky et al., 2007; Samet et al., 2008; Sherman et al., 2009), and the remaining five included clinic patients in South Africa (n=2) (Comman et al., 2008; Simbayi et al., 2004), military personnel in Angola (n=1) (Bing et al., 2008) and truck drivers in India (n=1) (Comman et al., 2007). A combined total of 39 887 people were included in the interventions, of whom 24 113 (60.5%) were heterosexual men. Just under half of the studies reported on interventions implemented among heterosexual men only (8 of 18).

Nine of the intervention conditions comprised individual-level counselling (one of which also included group sessions/workshops); group sessions/workshops only (n=8), and community outreach (n=2). The community outreach interventions comprised a variety of combination prevention components including information, education and community (IEC) activities (Gregson et al., 2007; Kamali et al., 2003), income-generating projects (Gregson et al., 2007), strengthening clinic-based management of sexually transmitted infections (STI) (Gregson et al., 2007; Kamali et al., 2003), social marketing and distribution of male condoms (Gregson et al., 2007) and peer education (Gregson et al., 2007). There were no differences between intervention and comparison conditions with regard to intervention format. For example, all nine intervention conditions that comprised individual-level counselling, had comparison conditions that consisted of individual-level counselling. Intervention exposure ranged from 15-minute single sessions with individual participants to 13, single- and mixed-sex, peer-group sessions. Comparison conditions' exposure ranged from 15-minute, single-session counselling to seven group sessions / workshops. Three studies' final follow-up assessments were conducted less than five months post intervention; 10 were conducted between six and 11 months post intervention; and six were conducted 12 or more months post intervention.

All interventions reported on changes in condom use between members in the two conditions at follow-up/s; 13 reported on numbers of sexual partners; five assessed problem alcohol use or alcohol use in contexts of sexual acts; and

Review of behavioural interventions for heterosexual men

two examined intimate partner violence (IPV). All studies provided a detailed and comprehensive description of both their respective intervention and control conditions. Two studies had “weak” global EPHPP ratings (Morsiky et al., 2004; Pechansky et al., 2007); six were rated as “strong” (Bing et al., 2007; Jewkes et al., 2008; Kamali et al., 2003; Kalichman et al., 2008; Kelly et al., 2006; Samet et al., 2008); and the remainder were rated “moderate”. The global ratings are expanded upon in the ensuing section. Ten studies provided some monetary recompense for participation in their respective interventions and/or at baseline and follow-up assessment. These ranged from \$2 to \$24.

Country-specific interventions

Angola

One article that met our review criteria reported on an intervention conducted in this country (Bing et al., 2006). This study was rated “strong” and therefore had no EPHPP-defined weaknesses. In the intervention 12, geographically separate military bases were paired, and within each pair, one base was randomly assigned to receive either a HIV prevention intervention that included malaria prevention (experimental condition comprising 280 men) or a malaria prevention intervention only (control condition comprising 288 men). The HIV intervention comprised five, daily group sessions based on the information-behaviour-motivation (IMB) model of behaviour change, and included a one-hour malaria prevention component. The malaria prevention intervention, based on the Angolan Armed Forces’ existing malaria prevention programmes was of the same format and duration as the experimental condition’s HIV intervention. Participants at each base were randomly sampled by military personnel and not the research staff. Participation in the intervention was voluntary.

Intervention effects showed a significant increase in condom use during vaginal sex with all partner types at three month follow-up, but this effect was not sustained at six months. There was no difference in the numbers of occasional and commercial sex partners, or alcohol consumption before sex between the two groups at either three or six months. The authors suggest that a simultaneous, national HIV prevention radio programme may have been responsible for the few differences in behaviours between the two intervention groups.

Brazil

We found one article reporting on an intervention conducted in Brazil among cocaine injectors and crack smokers (Pechansky et al., 2007). This study was rated as “weak” because individuals who participated in the intervention were not likely to be representative of the target population, and the authors did not provide any indication of whether and how many individuals approached refused to participate. This pilot study was a quasi-experimental clinical trial (considered a weak study design according to EPHPP criteria) to compare an intervention condition that comprised National Institute on Drug Abuse (NIDA), standard pre- and post-HIV test counselling that incorporated thought mapping/structured stories to decrease HIV risk behaviours (n=57), to a “treatment as usual” condition, i.e. NIDA, standard pre- and post-HIV test counselling only

Review of behavioural interventions for heterosexual men

(n=62). Potential participants, who were all heterosexual men, were purposively sampled during a street recruitment drive, and allocated to either condition according to previously blocked days of the week on which they presented at the study site.

Intervention effects showed a significant increase in condom use during vaginal sex. However, the intervention had no significant effect on the reported number of sexual partners in the previous thirty days. The small size who were largely self-referred, and questionable representativeness of the sample prompts cautious interpretation of these data. Longer follow-up period/s may have seen different intervention effects. The authors suggest that the similarity between the comparison and intervention components may have accounted for the limited intervention effects.

Bulgaria

The review identified one article reporting on an intervention that was conducted in this country among impoverished Roma (Gypsy) men (Kelly et al., 2006). This study was rated “strong” and therefore had no EPHPP-related weaknesses. In this randomized controlled trial, the intervention condition consisted of identifying “social circles” and their respective natural leaders (called indexes). Indexes were asked to identify members of their social networks who were then contacted and recruited for participation (n=286). A randomization table was used to assign the social networks to either the intervention (n=26) or control (n=26) conditions. In both conditions participants received individual HIV risk reduction counselling. This was the only intervention received by the control group (n=137). In the intervention group (n=145), a designated leader in each network was trained on how to counsel and advise others in their networks on HIV risk reduction behaviour. Training comprised five, weekly sessions and follow-up booster sessions. Intervention participants were followed-up at three and 12 months after the final training session.

Whether network leaders were included in the analysis or not, compared to men in the control condition, those in the intervention condition significantly increased condom use with all female sexual partners; a behaviour change that was sustained at 12 months. Despite these positive effects, the Roma community in which the intervention was implemented cannot be said to be representative of other Roma communities.

India

One article reported on an intervention conducted among long-distance truck drivers in this country (Cornman et al., 2007). This study was rated “moderate” because of uncontrolled, potential confounders. Specifically, at baseline, men in the intervention condition compared to those in the control condition had significantly more lifetime and prior four-month sexual partners, were more likely to have had sex with non-marital partners in the prior four months and were more likely to be under the influence of alcohol when having sex with non-marital partners. Despite these differences the authors chose not to include these behaviours as covariates in the analysis stating that “..none of these constructs related to risky sexual behaviour” (Cornman et al., 2007, p. 1577). Participants were recruited at a truck booking office while they were waiting for

Review of behavioural interventions for heterosexual men

their next assignment. A total of 17 workshops were randomly assigned to either the intervention (n=9) or control (n=8) conditions. The intervention workshop addressed specific information, motivation, and behavioural skills deficits found among truck drivers during research conducted prior to the intervention. It focused on motivating men to use condoms with all partners. The control condition workshop comprised a didactic HIV/AIDS prevention information session. Men in both conditions were assessed immediately following the intervention and followed-up 10 months later.

Intervention effects showed a significant increase in condom use (measured as the total number of times condoms were used and the frequency of condom use in the prior four months) with marital partners immediately after the intervention, which was sustained 10 months later; a significant increase in condom use with non-marital partners at 10 months but not immediately following the intervention; and a significant decrease in the number of non-marital partners 10 months after the intervention. More importantly, the authors found significant mediational effects of the IMB constructs on condom use with marital partners that suggests that IMB content in an intervention can impact risky sexual practices among their sample of truck drivers. The intervention had positive and enduring effects among Indian truck drivers despite the weakness outlined above, no indication of whether and how many individuals refused to participate in the intervention, and high attrition.

Nigeria

There was one published article on an intervention implemented in this country, and this study was rated as “moderate”. The intervention was among men only (Exner et al., 2009), and focused on communication and negotiation skills for safer sex and on fostering gender-equitable attitudes. Partners of women attending family planning clinics and men from the local community were recruited for participation. Two hundred and eighty-one men participated in this quasi-experimental study (considered a weak study design according to EPHPP criteria); 149 in the intervention group and 132 in the comparison group. The comparison condition consisted of a half-day, didactic workshop covering sexuality, reproduction, contraception and HIV/STI transmission, symptoms, treatment and prevention. Men were not randomly assigned to each intervention condition, rather pre-matched geographical areas were assigned to either of the conditions and men recruited in the respective areas participated in the assigned intervention.

Exner et al. (2009) found that condom use with main partners among intervention compared to control participants was significantly higher at three-month follow-up. A number of limitations suggest that results should be interpreted with caution: the study had a small, non-representative sample; the authors did not provide any indication of whether and how many individuals refused to participate; there was high attrition at follow-up; and final post-intervention assessment was done at three months. Longer term intervention effects are thus unknown.

Phillipines

Review of behavioural interventions for heterosexual men

This article reports on a community-based HIV/AIDS risk reduction intervention targeting heterosexual male clients of commercial sex workers developed and implemented in six study areas in the southern part of this country (Morisky et al., 2004). The study was rated as “weak” because of its quasi-experimental design and there was no assessment of potential confounders in the analysis. Six male population groups who were representative of the entire population of males in the study areas were targeted for inclusion in the study: an air force squadron, police and firemen, industrial workers, taxi drivers, pedicab drivers, and community residents. Following presentation of baseline results from all participants (n=3389), between 10 and 20 peer counsellors were recruited from each target group. After receiving training, peer counsellors were expected to educate at least 10 of their peers on HIV/AIDS/STI prevention and to participate in the development of various IEC materials. A cross-over study design was employed where peer educators were active for a period of 11 months among the intervention participants, and three months thereafter were active for the same period of time among the previous control participants.

Intervention effects showed that condom use at last sex increased significantly at post-test and was sustained at 12-month follow-up. As this intervention targeted male clients of sex workers, the authors report that condom use behaviour (not specified) increased among community members at 12-month follow-up but not at post-test; among workers and taxi drivers between post-test and 12-month follow-up; and among air force personnel and tricycle drivers at post-test but not between pre-test and 12-month follow-up. However, condom use decreased among police/firemen at post-test and 12-month follow-up. Although the authors attempted to recruit participants among groups as representative of clients of CSW as possible, participants were largely self-referred and the authors did not report whether and how many individuals refused to participate. It is also unknown whether assessor/s were blinded to which participants received / did not receive the intervention.

Russia

One article reports on a randomized controlled trial among patients with alcohol and/or heroin dependence in two substance abuse treatment, narcology hospitals in St. Petersburg (Sherman et al., 2008). The study was rated “strong” and therefore had no weak EPHPP-related elements. Patients were randomly assigned to either the intervention (n=87) or the control condition (n=94). The intervention component of the Partnership to Reduce the Epidemic Via Engagement in Narcology Treatment (PREVENT) comprised two counselling sessions whilst in treatment that included pre- and post-HIV test counselling, provision of testing results, discussion of personal risk and risk reduction, and creation of a personal behavioural change plan. Three, monthly booster sessions were conducted by telephone after discharge from hospital. Patients in the control condition received usual addiction treatment, HIV testing, but not sexual behaviour counselling. They were also contacted monthly for three months, but did not receive any counselling during these telephone calls.

Review of behavioural interventions for heterosexual men

Intervention effects showed a significant increase in the median percentage of safe sex episodes (i.e. during which condoms were used) at six months. However, after controlling for baseline percentage of safe sex episodes, the intervention effect diminished. Likewise, there was a significant increase in the median number of unsafe episodes in the past three months, but after controlling for baseline number of unsafe sex episodes and trading sex for drugs, the intervention effect diminished. The most rigorous intervention effect was the significant increase in any condom use during the past three months, which persisted after adjusting for any condom use and sex trade at baseline. The authors report that the intervention was more effective among alcohol-dependent patients than drug-dependent patients, and among people with fewer depressive symptoms. Despite the overall strength of the study and the largely positive intervention effects, the sample was small and only recruited from two drug treatment facilities in the city. Generalizability to other drug users having undergone treatment is thus not possible.

South Africa

Of the articles reporting on six interventions, three were health facility-based among HIV-positive people (Cornman et al., 2008) and sexually transmitted infection patients (Kalichman et al., 2007; Simbayi et al., 2004); two were localized, community-based interventions (Kalichman et al., 2008; Kalichman et al., 2009); and one was a large-scale, community-based intervention. (Jewkes et al., 2008).

The health facility-based interventions were randomized clinical trials. In one (Cornman et al., 2008), HIV-infected hospital outpatients were randomly assigned to either a standard-of-care, control condition comprising counselling about HIV, anti-retroviral medication and adherence, and nutrition or the *Izindela Zokuphila*/Options for Health intervention condition. In the *Izindela Zokuphila* condition participants received standard-of-care and patient-centered, systematic counselling on HIV prevention based on the information-motivation-behavioural skills model of HIV-prevention behaviour. This study was rated “moderate” as the authors did not include any indication of the reliability or validity of the assessment tools. Because the intervention was implemented in one health facility, the sample size is small and cannot be said to be representative of all PWHA. In another study, participants were drawn from a sexually transmitted infection (STI) clinic (Kalichman et al., 2007). This intervention condition comprised alcohol-related HIV risk reduction among men and women during a single, one-on-one, 60-minute HIV and alcohol risk reduction behavioural skills counselling session (Kalichman et al., 2007). Participants in the control condition received a single, HIV risk reduction counselling session. Participants were randomly assigned to either condition at baseline. This study was rated “moderate” because participants and interventionists were not blinded to intervention objectives or assessments. Because the intervention was implemented in one health facility, the sample size was small and cannot be said to be representative of alcohol consumers. Furthermore, the study reported high rates of refusals to participate in the intervention and high follow-up attrition. In the third health facility-based

Review of behavioural interventions for heterosexual men

intervention (Simbayi et al., 2004), patients attending a STI clinic were randomly assigned to either a control condition that comprised a didactic, HIV information / educational HIV risk-reduction session or an intervention condition consisting of a motivational-skills building HIV risk reduction counselling session. This study was rated “moderate” because the authors provided no indication of the validity or reliability of the assessment tools. The intervention was implemented in one health facility only and the sample size was small. Thus study participants cannot be said to be representative of STI patients.

The two localized, community-based interventions drew participants from local townships (Kalichman et al., 2008, 2009). In one study, which was rated “strong” and therefore had no EPHPP-related weaknesses, the intervention condition comprised a single, three-hour HIV-alcohol education and motivation / behavioural skills group session (Kalichman et al., 2008), and the control condition received an HIV and alcohol risk reduction group session. Participants, men and women, were randomly assigned to either condition at baseline. Despite this study’s strength, participants were largely self-referred and, because participants were drawn from two communities only, cannot be generalized to all alcohol users. In the other study (Kalichman et al., 2009), participants (men only) in the intervention condition (residing in one township) received gender-based HIV prevention group sessions and those in the control group (residing in another, similar township) received a single, alcohol-HIV prevention group session. This study was rated “moderate” because participants were not likely to be representative of the target population and the authors failed to report whether and how many individuals refused to participate. The two townships were demographically similar and were randomly assigned to receive either the intervention or the control condition. However, the findings have limited generalizability because the intervention was implemented in two communities only,

The one large-scale community intervention was a cluster randomized controlled trials conducted in rural and peri-urban communities (Jewkes et al., 2008). This study was rated “strong” and therefore had no EPHPP-related weaknesses. This group-based intervention, Stepping Stones, was adapted for South Africa and implemented in 35 communities that had been randomly assigned to receive the intervention. It comprised participatory learning, critical reflection, role-play and drama drawing from everyday experiences and lives of participants, and consisted of 13 single-sex group sessions, three mixed-sex group sessions, and a final community meeting. The 35 communities randomly assigned to the control condition received a single session on HIV and safer sex. Despite this study’s strength, there was low intervention completion and high attrition. Furthermore, the authors report that contamination between the intervention communities may have existed and the comparison condition was similar in content to the experimental condition. Together these limitations may explain the minimal intervention effects.

Intervention effects with respect to condom use in the three health care facility studies showed a significant reduction in the mean number of unprotected sex events among HIV-positive people in the prior three months (Comman et

Review of behavioural interventions for heterosexual men

al., 2008); a significant reduction in unprotected sexual intercourse occasions and percent of unprotected sexual encounters in the previous three months among STI clinic patients (Simbayi et al., 2004); and a significant increase among alcohol-using STI patients in the percentage of condom use in the previous month at three and six months, and at last sex at three months, but not at six months (Kalichman et al., 2007). With respect to sexual partner numbers, neither Simbayi et al., (2004) nor Kalichman et al. (2007) showed a change in numbers of sexual partners at any follow-up points among STI clinic patients. Alcohol use in the context of sex among STI patients in the previous month declined significantly at three months, but was not sustained at six months (Kalichman et al, 2007).

Intervention effects with respect to condom use in the two local community studies showed a significant increase in the percentage of previous month protected sexual occasions, consistent condom use and completely protected sex at three months, but not at six months among alcohol users (Kalichman et al., 2008); and no change in condom use at one month, a decline at three months and no change at six months among community members (Kalichman et al., 2009). With respect to numbers of sexual partners, there was no change in the numbers of sexual partners in the previous three months at either assessment times in Kalichman et al's 2008 study; and number of sexual partners did not change at either one or three months, but declined significantly at six months in Kalichman et al's 2009 study. Alcohol use in the context of sex in the previous month declined significantly at both assessment times (Kalichman 2008) and alcohol use before sex increased at one month, but did not change at later assessments (Kalichman et al., 2009). The gender-based violence measures (having lost ones temper with a woman and having hit a sexual partner) declined by 6 months, but did not show shorter-term effects (Kalichman et al., 2009).

Among men only, Jewkes et al (2008) reported that their large-scale, community intervention had no effect on condom use or rape / attempted rape at 12- or 24-month follow-ups. Intervention effects showed marginal decreases in the number of sexual partners, problem alcohol use, transactional sex and intimate partner violence (IPV). Other than IPV, these marginal, positive effects were not sustained at 24 months.

Thailand

Two interventions were reported on in the same setting, Chiang Mai, in this country. Both interventions were implemented among drug users: injecting drug users (Latkin et al., 2009) and methamphetamine users (Sherman et al., 2009) and utilized network-based, peer education strategies. In the former study (Latkin et al., 2009), the intervention was also implemented in Philadelphia, United States among the same population. For purposes of this review, information relevant to the intervention as it was implemented in Thailand only is reported. Index participants were recruited and asked to bring one network member to the study site. Indexes were randomly assigned to either the intervention or the control condition and a total of 182 indexes and 245 network members were enrolled. All participants received voluntary HIV testing and counselling (VCT)

Review of behavioural interventions for heterosexual men

at each 6-month assessment comprising pre-and post-test counselling sessions that included discussion of personal risk and risk reduction, and creation of a personal behavioural change plan. The indexes also participated in six, network-oriented peer education training sessions and a further two booster sessions. The training comprised a variety of strategies to equip indexes to discuss, advise and communicate with peers about injecting and sexual risk reduction with their enrolled peer. This study was rated “moderate” because the validity or reliability of assessment tools was not reported.

In Sherman et al.'s (2009) report, index members were randomized into either the intervention or control condition and a total of 415 indexes and 568 network members were enrolled. Intervention indexes participated in seven, peer education training sessions and a further two booster sessions. The training comprised a variety of strategies to equip participants to discuss, advise and communicate with peers about methamphetamine use and sexual risk reduction with their enrolled peer. Control indexes participated in seven, peer education training sessions that focused on life skills and did not place any emphasis on communication about the content to network members. This study was rated “moderate” because the validity or reliability of assessment tools was not reported.

The intervention among injecting drug users had no effect on the number of past month sexual partners nor past week condom use with non-primary or any sexual partners (Latkin et al., 2009). The authors note that a government policy known as the “war on drugs” was operating while the intervention was being implemented and is likely to have negatively affected willingness of individuals to report drug use, reduced trust among drug users, and the amount of drug use among participants. Furthermore, there may have been contamination between the intervention groups, thus limiting the intervention effects. The intervention among methamphetamine users had no effect on consistent condom use in the past three months (Sherman et al., 2009). These authors also noted the possible negative effects of the government policy of “war on drugs” may have had on intervention effects. Furthermore, this study used non-random sampling and recruitment; the control condition was similar to the experimental intervention; there may have been contamination between the intervention groups; and there was low attendance at all the intervention sessions.

Uganda

Two articles published results from two interventions conducted in this country. One reported on a controlled community-level trial among men residing two peri-urban communities in Kampala (Kajubi et al., 2005) and the other on a community randomized trial among 18 rural communities in Masaka district (Kamali et al., 2003). In the former community-level intervention (Kajubi et al., 2005), one community received a condom promotion intervention comprising attendance at one of eight, three-hour intensive workshops addressing barrier to condom use: lack of condom use skills, lack of access to condoms, and embarrassment about accessing condoms (n=297). The other community received passive condom

Review of behavioural interventions for heterosexual men

availability with a brief AIDS information session (n=201). This study was rated “moderate” because the validity or reliability of assessment tools were not reported.

In the latter community-level intervention (Kamali et al., 2003), 18 communities were individually matched in triplets and each community within the triplet was randomly assigned to received one of three intervention conditions. Social marketing of male condoms and voluntary HIV counselling and testing were offered to people in all communities. The control condition included community development activities and general health-related issues. The one intervention condition included information, education and community activities (IEC) aiming to promote safer sex, provide knowledge and correct misconceptions about HIV/STI, and the other had these components in addition to improved STI management in the respective six communities (IEC+STI). This study was rated “strong” and therefore had no EPHPP-related weaknesses.

Intervention effects among men in the peri-urban communities showed no significant difference between intervention conditions on condom use in the past six months, but the median number of sexual partners among men in the intervention condition increased (Kajubi et al., 2005). These negative findings may have had to do with the sample not being representative of the target population; also because the intervention was implemented in two communities only. There may have been contamination between the two intervention groups and the authors were not able to report on non-attendance. Furthermore, attrition at follow-up was high. Intervention effects in the rural communities showed an increase in condom use with a most recent casual sexual partner; but no significant reduction in sexual partner numbers in the past year (Kamali et al., 2003). Both study authors report on the secular trends characteristic of a mature, stabilizing HIV epidemic in the country thus limiting intervention effects.

Ukraine

One article reported on an intervention implemented among injecting drug users (IDU) in three cities in this country (Booth et al., 2009). This study was rated “moderate” and used a cross-over experimental design (considered “weak” according to EPHPP criteria) and recruited an initial 900 IDU, followed by an inactive period of three months with no recruitment, a reversal of intervention assignment areas and a further recruitment of 900 IDU. Participants in two distinct sites (one to receive the intervention and one the control) in each city were recruited. The intervention comprised HIV pre- and post- rapid text counselling and education which was modified to include injecting drug use risk reduction, plus individualized risk reduction communication with outreach workers over a period of five months (n=450 at first recruitment and n=449 at second recruitment). In the control condition, participants were exposed to the adapted HIV pre- and post- rapid text counselling and education only (n=450 at first recruitment and n=449 at second recruitment).

There were no intervention effects on condom use nor number of partners with both intervention and control participants demonstrating equally significant reductions in these behaviours at six-month follow-up.

Review of behavioural interventions for heterosexual men

Zimbabwe

One article reported findings from an integrated community and clinic-based cluster randomized controlled trial conducted in eastern, largely rural Zimbabwe (Gregson et al., 2007). This study was rated “moderate” because of high dropout / withdrawal rates. Within six pairs of matched communities, one was randomly assigned to receive the intervention and the other the control. Enrolment of individuals was restricted to one randomly selected member per marital group. All communities received standard Government services: syndromic STI management, condom distribution and marketing, home-based care and limited HIV/AIDS information and education community (IEC) activities. Additional activities in the intervention communities included population-level strategies to promote safer sexual behaviour and to improve STI management: weekly, workplace and community peer education; condom distribution among commercial sex workers and their clients; income generating projects for women; and clinic-based strengthening of syndromic management of sexually transmitted infections; and open days at HIV/AIDS health centres to promote safer sex and uptake of STI services. A total of 63,261 peer-educator meetings were held and 6.8 million condoms were distributed in the intervention communities.

After adjusting for age, gender, marital status and baseline HIV prevalence, intervention effects at the individual level showed that, overall, condom use in general and condom use with regular partners was not different, but increased with casual partners; and multiple new sexual and casual partners numbers did not differ, but having more than two partners in the past 3 years decreased. The authors suggest a number of limitations that may have impacted on the intervention effects: possible contamination between intervention communities; another intervention being simultaneously implemented in some sites; negative role-modelling of peer educators; and secular trends characteristic of a mature, stabilizing HIV epidemic in Zimbabwe.

DISCUSSION

This review sourced articles from 19 LMICs where a variety of behavioural HIV prevention interventions were conducted among diverse populations or communities of heterosexual men. On the whole, the majority of the interventions reported positive behaviour changes with respect to condom use among their respective populations. However, those interventions that sought to reduce the number of sexual partners had little effect, and those that addressed alcohol consumption had mixed effects. The two interventions that sought to impact on IPV were largely successful.

Condom use

Correct and consistent use of condoms is one of the most reliable methods to prevent sexual transmission of HIV (Hearst & Chen, 2004; Shelton, 2006). The effectiveness of condoms in preventing HIV transmission or acquisition has been estimated to be approximately 90% (Hearst & Chen, 2004). It is not unexpected that all the studies measured the effects of their respective interventions on condom use among their populations. The majority of studies reported increases in condom

Review of behavioural interventions for heterosexual men

use in their respective intervention groups compared to comparison / control groups at post-intervention follow-ups. Only one study found a decrease in condom use among local community members in South Africa (Kalichman et al., 2009), but this effect was not sustained at six-month follow-up. Five studies found no increases in condom use among rural and semi-rural community members in South Africa (Jewkes et al., 2008); drug users in Thailand (Latkin et al., 2009; Sherman et al., 2009), Ugandan peri-urban community members (Kajubi et al., 2003), and injecting drug users in Ukraine (Booth et al., 2009). Three studies found that increases in condom use was not sustained to later, post-intervention follow-ups (Bing et al., 2009; Kalichman et al., 2007, 2008).

The 10 studies that reported positive intervention effects on condom use are varied in terms of setting, target populations, and intervention content and format. For example, they were conducted in nine different countries; two among people who use drugs or who are in treatment for drug use, four among community members, and one each among long distance truck drivers, PLWHA and STI patients. Furthermore, four used individual counselling, two used group workshop formats, three employed a peer educator approach, and one was a large-scale community outreach intervention. The heterogeneity of settings, populations and intervention format does not permit any overall conclusions about what may have contributed to the interventions' respective "success" in impacting positively on condom use behaviour. However, six of the 10 studies were conducted among small samples that were either not representative of the target population and/or non-generalizable, and five provided monetary recompense to participants for assessments or intervention attendance. Taken together this suggests that, before any conclusive evaluation regarding success in impacting on condom use can be made, interventions should possibly be replicated with larger populations or with similar populations in other settings. It also suggests that careful consideration needs to be made about the possible impact on motivations to participate and social desirability of responses to assessment questions that monetary "reward" may have had (Noguchi, Albarracin, Durantini & Glasman, 2007; Talbot, 1999). Finally, longer time periods for post-intervention assessments should be considered as seven of the studies had post-intervention follow-ups at six months or less.

Three of the five interventions that showed no effect on condom use, used peer education / outreach strategies among drug users, two of which also provided monetary reimbursements to participants for assessments. These studies were all rated "moderate". Findings suggest that peer outreach strategies may not be suitable for promoting condom use, particularly among drug users, or that drug users may face particular challenges when attempting to access or use condoms more consistently. Furthermore, payment for assessments may have introduced sampling biases in the two studies that provided this inducement (Talbot, 1999). The other two interventions that showed no effect on condom use were conducted among peri-urban and rural populations, which may point to particular challenges that these populations may be confronted with when attempting to access or use condoms more consistently.

Review of behavioural interventions for heterosexual men

The three interventions that showed no sustained changes in condom use at follow-up assessment incorporated the principles of information-motivation and behaviour skills (IMB) implemented in brief one-on-one counselling format, or multiple group formats. Although four of the “successful” interventions referred to above also incorporated IMB principles, this finding does question the IMB model's ability to sustain behaviour change with respect to condoms. However, one of the studies among alcohol users reported a 36% refusal rate that may also have introduced a sample bias and thus affected this intervention's outcomes (Kalichman et al., 2007). It is possible that those people who participated, compared to those who refused were less likely to be those in need of an intervention to impact on their (risky) behaviour/s (Noguchi et al., 2007). Furthermore, in two studies, participants were recompensed for assessments which may have biased the sample in a systematic way (Kalichman et al., 2007, 2008). It is possible that participants' motivations for enrolling in the intervention may have had more to do with monetary “reward” than a desire to benefit or assist (Talbot, 1999). This issue is particularly relevant in LMICs.

Despite Hearst & Chen's (2004) conclusion that there was no evidence, anywhere in the world, to suggest that a generalized HIV epidemic has been reversed as a result of increased / consistent condom use, these studies' interventions to increase correct condom use were largely effective. There does, however, need to be a sensitivity to the challenges some populations may face in accessing and consistently using condoms. Awareness of the shortcomings of some intervention strategies also need to be considered. Finally, the use of monetary reimbursement for participation in follow-up assessment needs to be carefully weighed against the risk of sample bias that this may introduce, particularly where the population being sampled is largely poor, as in the case of South Africa. Even if we accept that increased condom use may not reverse an epidemic, in combination with other (positive) behaviour changes, this behavioural change is likely to impact on the spread of HIV, and should continue to be the cornerstone of HIV prevention efforts both globally and in LMICs.

Multiple sexual partners

Although not incontrovertible (Lurie & Rosenthal, 2010), one of the risk behaviours thought to be a significant factor in the spread and persistence of HIV in southern Africa is multiple, concurrent sexual partners (MCP): a behaviour that has received a great deal of recent attention and debate (Epstein, 2008, 2010; Green, Mah, Ruark & Hearst, 2009; Halperin & Epstein, 2004; Lurie & Rosenthal, 2010; Mah & Halperin, 2010a & b; Morris, 2010). MCP has been inconsistently defined and measured in the literature to date (Nelson et al., 2007), but is generally considered to be instances where an individual has two or more sexual relationships that overlap in time (UNAIDS, 2009c). Although having multiple sexual partners does not necessarily mean that they are also concurrent, it does point to high partner turnover, the possibility of concurrency, and concomitant risk for HIV.

Review of behavioural interventions for heterosexual men

Findings from the 13 studies whose interventions targeted and measured numbers of sexual partners (not necessarily concurrent), suggest that they had limited effects on this behaviour. One study showed a significant reduction in the number of casual sexual partners among Indian truck drivers (Cornman et al., 2007) and another showed a significant reduction in the number of sexual partners among township community members in South Africa at six-month follow-up, that had not been found at one- and three-month follow-up times (Kalichman et al., 2009). Both these interventions were conducted among groups of participants and incorporated IMB principles suggesting that the IMB model implemented in group settings shows promise for interventions aimed at sexual partner reduction. However, the findings are not generalizable to other populations of truck drivers, whether in India or elsewhere, nor other township communities in South Africa. Both studies provided monetary recompense for assessments, which may have introduced sampling and/or response biases as outlined above.

Two other interventions showed a reduction at first follow-up that was not sustained at later follow-up among South African rural and semi-rural community members (Jewkes et al., 2008) and among township community members (Kalichman et al., 2008) in South Africa. The intervention among Zimbabwean rural community members showed a reduction in numbers of people reporting two or more partners in the past year, but not among members reporting multiple new or casual partners in the past year (Gregson et al., 2007). This limited evidence may point to large-scale and community-based interventions as being appropriate for impacting on partner numbers, albeit that positive changes were not sustained, and depended on the way in which having multiple partners is measured.

As with condom use, those interventions that aimed to impact on sexual partner numbers are heterogeneous with respect to setting, target populations, and intervention content and format. It is thus difficult to provide any conclusions about what and why some interventions failed, and to make any recommendations for future interventions focusing on this behaviour. Of note, however, is that four of the seven interventions involved individual level counselling suggesting that this format may have little effect on reducing sexual partner numbers. The issue of sample bias in three of the unsuccessful interventions due to payment for assessments (Kalichman et al., 2007, 2009; Simbayi et al., 2004), and refusal to participate (Kalichman et al., 2007) may also be relevant here (Noguchi et al., 2007; Talbot, 1999).

Alcohol use

Of the five studies that reported on their respective interventions' effects on alcohol use, findings are mixed. In one intervention, alcohol use in the context of sexual encounters sustained a decrease over time among local South African community members (Kalichman et al., 2008). Of note in this study is the similarity in intervention aims for both groups: alcohol reduction. The fact that the experimental group's enhanced alcohol reduction intervention that incorporated IMB principles suggests the promise of the IMB model in group settings to impact on alcohol use. Two other interventions

Review of behavioural interventions for heterosexual men

demonstrated only short-term reductions in alcohol use among sexually transmitted infection patients in South Africa (Kalichman et al., 2007) and among South African rural and semi-rural community members (Jewkes et al., 2008). However, these interventions are not comparable because in the former, alcohol use in the context of sex was assessed and in the latter, generalized problem alcohol use was measured. In another intervention among Angolan military personnel (Bing et al., 2008), there was no effect at any follow-up times on alcohol use when consumed before sexual encounters. This study used a single item to measure this behaviour and the negative finding thus needs to be interpreted with caution. One intervention among township community members in South Africa (Kalichman et al., 2009) in fact found an increase in alcohol use before sex at one-month post-intervention assessment, although this was not sustained at three- and six-month assessments. Because the control condition in this intervention also focused on alcohol reduction, it is perhaps not unexpected that their findings did not show any significant differences between their intervention group in the longer term.

Given these mixed findings, recommendations for future interventions focusing on this behaviour is difficult. Four of the five interventions incorporated principles of IMB. Of these one showed positive effects, one found no effect, and two demonstrated short-term, but not long-term effects on alcohol use. It is unlikely that these varying effects can be attributed to poor quality studies as they none had a weak EPHPP rating. This suggests then, that interventions that incorporate the IMB principles of risk reduction may be effective, albeit possibly only in the short-term, in reducing risky alcohol consumption. However, given the plethora of research evidence that links problem alcohol use and alcohol use in the context of sexual encounters (Fisher, Bang & Kapiga, 2007; Kalichman, Simbayi, Kaufman, Cain & Jooste, 2007b; Shuper, Joharchi, Irving & Rehm, 2009; Baliunas, Rehm, Irving & Shuper, 2010), the paucity of interventions targeting this risky behaviour and the inconclusive evidence of their effectiveness is lamentable.

Other risk behaviours

There is increasing and convincing evidence that intimate partner violence (IPV) / gender-based violence (GBV) is a major risk factor for HIV (Jewkes & Morell, 2010; Jewkes, Dunkle, Nduna & Shai, 2010). It is thus not unexpected that addressing violence against women is one of the nine priority areas identified by the UNAIDS Outcome Framework for 2009-2011 (UNAIDS, 2009d). Only two studies' interventions sought to address IPV / GBV among rural and semi-rural community members (Jewkes et al., 2008) and local community members in South Africa (Kalichman et al., 2009). Both interventions were successful, showing a sustained (albeit not significant) decrease over time, and a long-term rather than short-term effect on this behaviour. These interventions were conducted among relatively disparate populations (rural and semi-rural, and urban informal populations), and the theoretical grounding of each was quite different. They were rated "strong" (Jewkes et al., 2008) and "moderate" (Kalichman et al., 2009) on EPHPP criteria suggesting that interventions targeting IPV and GBV may have wide acceptability, irrespective of the type of intervention, particularly in South Africa.

Conclusion

This review has provided a synthesis of behavioural interventions among heterosexual men in LMICs and an evaluation of the interventions and studies so that interventionists looking to impact on their respective populations' high-risk behaviours are also aware of the weaknesses of those in this review. A limitation which is not unique to this review, is the possibility of inadvertently excluding some reports on interventions that may not have been included in the resources that were searched.

Several limitations among the studies that comprise the review need mention. First, all had short post-intervention, follow-up assessments rarely stretching beyond 12 months, and longer-term post-intervention assessments among high-risk groups may have shown more positive effects. Indeed it has been suggested that assessments at five years or more are more likely to show significant population-level effects (Hallett, Garnett, Mupamberiyi & Gregson, 2007). Second, contamination between intervention participants which may have helped explain limited, negative or contrary results was not addressed by the majority of studies. Third, refusals to participate in, and dropout from intervention session/s that also may have assisted in explaining limited, negative or contrary results was not addressed by the majority of studies. Fourth, behavioural interventions in many of the studies required interviewer-administered questionnaires and no sensitivity to the possible effects of unblinded assessments was shown. Fifth, it is possible that participants may have provided socially desirable responses to assessment questions, particularly as they would surely not have been unaware of the behaviour/s the intervention were seeking to impact. Taken together, these limitations indicate that conclusions drawn should be viewed with some caution. Strengths of the studies are the inclusiveness with which they reported the content of their respective intervention components, the detailed description of the ways in which participants were allocated to the intervention conditions, a clear description of attrition during post-intervention assessments, and the reporting of baseline data.

Given that this review was able to source only 19 appropriate studies reported over a period of almost a decade, suggests that more interventions for heterosexual males in LMICs are needed. Even if we acknowledge that there are interventions being implemented among heterosexual men in LMICs, but not reported or at best reported in the largely difficult to access "grey literature", it would seem that heterosexual men remain a "forgotten group" (Exner, et al., 1999). The findings from this review also revealed a disappointing lack of overall evidence for any specific format of intervention that impacted best on any of the targeted risk behaviours. Further, there is a distinct need for interventions to address multiple sexual partners and alcohol use. The interventions seeking to change these two risk behaviours showed limited effectiveness that in many instances was not sustained at follow-ups. Future studies evaluating such interventions would be well advised to strive for consistent measurement of partner numbers and alcohol outcomes. For example, numbers of sexual partners during a consistently applied, specific prior time period (for example, in the past three or six months) is needed as is the need to disaggregate such numbers into main partners (spouses or steady girlfriends), casual long-term

Review of behavioural interventions for heterosexual men

partners outside of main relationships, and one night stands. Similarly, a consistent measure of alcohol use needs to be adopted. For example, either an overall problem alcohol consumption measure or a measure of alcohol use in the context of sex. A great deal more effort needs to go into interventions addressing IPV. Although based on very limited evidence from this review of studies, interventions addressing IPV may be welcomed in target populations, and thus be acceptable and effective. Interventionists will also need to decide whether the payment of any form of recompense to participants is worth the probable bias in the samples this introduces, particularly in LMICs.

Research efforts need to focus on rigorous evaluation of HIV prevention interventions to provide a strong evidence base for prevention efforts among heterosexual males in LMICs. Rather than relying on correlations between behavioural measures as indicators of intervention effectiveness, it may be prudent for intervention evaluation strategies to include biological measures in research designs; namely HIV prevalence or incidence rates (Padian et al., 2010). That being said, due consideration needs to be given to the additional expense required for evaluations that include biological measures, and a careful allocation of limited resources will need to be allocated to evaluation efforts. While randomized controlled trials will remain the gold standard for providing an evidence base for prevention programmes (Padian et al., 2010), perhaps easily accessible, good quality, consistent data are the best that can be striven for in the current economic climate (Hallett et al., 2007).

There is validity in the argument that no magic bullet, single-level HIV prevention is likely to be effective in reversing the HIV/AIDS epidemic, and that combination prevention (a combination of behavioural, biomedical and structural actions) is more likely to have the strongest and most enduring impact on reducing HIV infection (Merson et al., 2008). But, until the reality of resource constraints and dwindling funding is reversed, arguably the best, and very least that LMICs can do, is to implement and continue with behavioural interventions among heterosexual men that are shown to be effective.

ACKNOWLEDGEMENTS

Loraine Townsend and Yanga Zembe were supported by the Columbia University-Southern African Fogarty AIDS International Training and Research Program 9AITRP) funded by the Fogarty International Center, National Institutes of Health (grant X D43TW00231) (May to July 2010)

REFERENCES

- Baliunas, D., Rehm, J., Irving, H. & Shuper, P. (2010). Alcohol consumption and risk of incident human immunodeficiency virus infection: a meta-analysis. *International Journal of Public Health*, 55, 159-166.
- Bing, E.G., Cheng, K.G., Oritz, D.J., Ovalle-Bahamón, R.E., Ernesto, F., Weiss, R.E. et al. (2008). Evaluation of a prevention intervention to reduce HIV risk among Angolan soldiers. *AIDS & Behavior*, 12, 384-395.
- Booth, R.E., Lehman, W.E.K., Dvoryak, S., Brewster, J.T. & Sinitsyna, L. (2009). Interventions with injecting drug users in Ukraine. *Addiction*, 104, 1864-1873.
- Centers for Disease Control and Prevention (CDC) (2001) Compendium of HIV Prevention Interventions with Evidence of Effectiveness. Accessed on 3rd June 2010, from http://www.cdc.gov/hiv/resources/reports/hiv_compendium/
- Comman, D.H., Schmiede, S.J., Bryan, A., Benziger, T.J. & Fisher, J.D. (2007). An information-motivation-behavioral skills (IMB) model-based HIV prevention intervention for truck drivers in India. *Social Science & Medicine*, 64, 1572-1584.
- Comman, D.H., Kiene, S., Christie, S., Fisher, W., Shuper, P.A. Pillay, S., et al. (2008). Clinic-Based Intervention Reduces Unprotected Sexual Behavior Among HIV-Infected Patients in KwaZulu-Natal, South Africa: Results of a Pilot Study. *Journal of Acquired Immune Deficiency Syndromes*, 48(5), 553-560.
- Effective Public Health Practice Project (2009). Quality assessment tool for quantitative studies. Accessed on 2nd August, 2010 from <http://www.ehphp.ca/Tools.html>
- Epstein, H. (2008). *The invisible cure. Why we are losing the fight against AIDS in Africa*. New York: Picador.
- Epstein, H. (2010). The mathematics of concurrent partnerships and HIV: A commentary on Lurie and Rosenthal, 2009. *AIDS & Behavior*, 14(1), 29-30.
- Exner, T.M., Gardos, P.S., Seal, D.W. & Ehrhardt, A.A. (1999). HIV sexual risk reduction interventions with heterosexual men: The forgotten group. *AIDS & Behavior*, 3, 347-358.
- Exner, T.M., Mantell, J.E., Adekun, L.A., Udoh, I.A., Lapido, O.A., Delano, G.E. et al. (2009). Mobilizing men as partners: the results of an intervention to increase dual protection among Nigerian men. *Health Education Research*, 846-854, doi:10.1093/her/cyp021.
- Fisher, J.C., Bang, H. & Kapiga, S.H. (2007). The association between HIV infection and alcohol use: A systematic review and meta-analysis of African studies. *Sexually Transmitted Diseases*, 34, 856-863.
- Global HIV Prevention Working Group (2007). Bringing HIV prevention to scale: an urgent global priority. Accessed on 10th June 2010 from www.globalhivprevention.org/reports.html
- Green, E.C., Mah, T.L., Ruark, A. & Hearst, N. (2009). A framework of sexual partnerships: risks and implications for HIV prevention in Africa. *Studies in Family Planning*, 40(1), 63-70.

Review of behavioural interventions for heterosexual men

- Gregson, S., Adamson, S., Papaya, S., Mundondo, J., Nyamukapa, C.A., Mason, P.R. et al. (2007). Impact and process evaluation of integrated community and clinic-based HIV-1 control: a cluster-randomised trial in Eastern Zimbabwe. *PloS Medicine*, 4(3), 545-555.
- Hallett, T.B., Garnett, G.P., Mupambieri, Z. & Gregson, S. (2007). Measuring effectiveness in community randomized trials of HIV prevention. *International Journal of Epidemiology*, 37, 77-87.
- Halperin, D. & Epstein, H. (2004). Concurrent sexual partnerships help to explain Africa's high HIV prevalence: implications for prevention. *The Lancet*, 364 (9429), 4-6.
- Hearst, N. & Chen, S. (2004). Condom promotion for AIDS prevention in the developing world? Is it working? *Studies in Family Planning*, 35(1), 39-47.
- Izazola-Licea, J.A., Wiegmann, J. Arán, C. Guthrie, Y., De Lay P. & Avila-Figueroa, C. (2009). Financing the response to HIV in low-income and middle-income countries. *Journal of Acquired Immune Deficiency Syndromes*, 52, S119-S126.
- Jewkes, R., Nduna, M., Levin, J., Jama, N., Dunkle, K., Puren, A. et al. (2008). Impact of Stepping Stones on incidence of HIV and HSV-2 and sexual behaviour in rural South Africa: Cluster randomised controlled trial. *British Medical Journal*, 337:a506, doi:10.1136/bmj.a506.
- Jewkes, R. & Morrell, R. (2010). Gender and sexuality: emerging perspectives from the heterosexual epidemic in South Africa and implications for HIV risk and prevention. *Journal of the International AIDS Society*, 13(6). Accessed on 13 July 2010 from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2828994/>
- Jewkes, R., Dunkle, K., Nduna, M. & Shai, N. (2010). Intimate partner violence, relationship power inequity, and incidence of HIV infection in young women in South Africa: a cohort study. *The Lancet*, 376, 41-48.
- Kajubi, P., Kamya, M.R., Kamya, S., Chen, S., McFarland, W. & Hearst, N. (2005). Increasing condom use without reducing HIV risk. *Journal of Acquired Immune Deficiency Syndromes*, (40), 77-82).
- Kalichman, S.C., Simbayi, L.C., Vermaak, R., Cain, D., Jooste, S. & Peltzer, K. (2007). HIV/AIDS risk reduction counseling for alcohol using sexually transmitted infections clinic patients in Cape Town, South Africa. *Journal of Acquired Immune Deficiency Syndromes*, 44, 594-600.
- Kalichman, S.C., Simbayi, L.C., Kaufman, M., Cain, D. & Jooste, S. (2007b). Alcohol use and sexual risks for HIV/AIDS in sub-Saharan Africa: Systematic review of empirical findings. *Prevention Science*, 8, 141-151.
- Kalichman, S.C., Simbayi, L.C., Vermaak, R., Cain, D., Smith, G., Mthebu, J. et al. (2008). Randomized trial of a community-based alcohol-related HIV risk-reduction intervention for men and women in Cape Town South Africa. *Annals of Behavioral Medicine*, 36, 270-279.

Review of behavioural interventions for heterosexual men

- Kalichman, S.C., Simbayi, L.C., Cloete, A., Clayford, M., Arnolds, W., Mxoli, M. et al. (2009). Integrated gender-based violence and HIV risk reduction intervention for South African men: Results of a quasi-experimental field trial. *Prevention Science*, 10, 260-269.
- Kamali, A., Quigley, M., Nakiyingi, J., Kinsman, J., Kengeya-Kayondo, J., Gopal, R. et al. (2003). Syndromic management of sexually-transmitted infections and behaviour change interventions on transmission of HIV-1 in rural Uganda: a community randomised trial. *The Lancet*, 361, 645-652.
- Kelly, J.A., Somlai, A.M., DiFranceisco, W.J., Otto-Salaj, L.L., McAuliffe, T.L., Hackl, K.L. et al. (2000). Bridging the gap between science and service of HIV prevention: Transferring effective research-based HIV prevention interventions to community AIDS service providers. *American Journal of Public Health*, 90(7), 1082-1088.
- Kelly, J.A., Amirkhanian, Y.A., Kabakchieva, E., Vassileva, S., McAuliffe, T.L., DiFranceisco, W.J. et al. (2006). Prevention of HIV and sexually transmitted diseases in high risk social networks of young Roma (Gypsy) men in Bulgaria: randomised controlled trial. *British Medical Journal*, 333, 1098-1101.
- Latkin, C.A., Donnell, D., Metzger, D., Sherman, S., Aramrattna, A., Davis-Vogel, A. et al. (2009). The efficacy of a network intervention to reduce HIV risk behaviors among drug users and risk partners in Chiang Mai, Thailand and Philadelphia, USA. *Social Science & Medicine*, 68, 740-748.
- Lurie, M.N. & Rosenthal, S. (2010). Concurrent partnerships as a driver of the HIV epidemic in sub-Saharan Africa? The evidence is limited. *AIDS & Behavior*, 14(1), 17-24.
- Mah, T.L. & Halperin, D.T. (2010a). Concurrent sexual partnerships and the HIV epidemics in Africa: Evidence to move forward. *AIDS & Behavior*, 14, 11-16.
- Mah, T. & Halperin, D.T. (2010b). The evidence for the role of concurrent partnerships in Africa's HIV epidemics: A response to Lurie and Rosenthal. *AIDS & Behavior*, 14(1), 25-28.
- McCoy, S.I., Kangwende, R.A. & Padian, N.S. (2010). Behavior change interventions to prevent HIV infection among women living in low and middle income countries: A systematic review. *AIDS & Behavior*, 14, 469-482.
- Médecins Sans Frontières (2010). No time to quit: HIV/AIDS treatment gap widening in Africa. Brussels: Author.
- Merson, M., Padian, N., Coates, T.J., Rao Gupta, G., Bertozzi, S.M., Piot, P. et al. (2008). Combination HIV prevention. *The Lancet*, 372(9652), 1805-1806.
- Morisky, D.E., Ang, A., Coly, A. & Tiglaio, T.V. (2004). A model HIV/AIDS risk reduction program in the Philippines: a comprehensive community-based approach through participatory action research. *Health Promotion International*, 19(1), 69-76.

Review of behavioural interventions for heterosexual men

- Morris, M. (2010). Barking up the wrong evidence tree. Commentary on Lurie & Rosenthal, "Concurrent partnerships as a driver of the HIV epidemic in sub-Saharan Africa? The evidence is limited". *AIDS & Behavior*, 14(1), 31-33.
- Nelson, S.J., Manhart, L.E., Gorbach, P.M., Martin, D.H., Stoner, B.P., Aral, S.O. et al., (2007). Measuring sex partner concurrency: it's what's missing that counts. *Sexually Transmitted Diseases*, 34 (10), 801-807.
- Noguchi, K., Albarracín, D., Durantini, M.R. & Glasman, L.R. (2007). Who participates in which health promotion programs? A meta-analysis of motivations underlying enrollment and retention in HIV-prevention interventions. *Psychological Bulletin*, 133(6), 955-975.
- Pechansky, F., Bassani, D.G., Von Diemen, L., Kessler, F., Leikefeld, C.G., Surratt, H.L. et al. (2007). Using thought mapping and structured stories to decrease HIV risk behaviors among cocaine injectors and crack smokers in the South of Brazil. *Revista Brasileira de Psiquiatria*, 29(3), 233-240.
- Padian, N.S., McCoy, S.I., Balkus, J.E. & Wasserheit, J.N. (2010). Weighing the gold in the gold standard: challenges in HIV prevention research. *AIDS*, 24, 621-635.
- Samet, J.H., Krupitsky, E.M., Cheng, D.M., Raj, A., Egorova, V.Y., Levenson, S. et al. (2008). Mitigating risky sexual behaviors among Russian narcology hospital patients: the PREVENT (Partnership to Reduce the Epidemic Via Engagement in Narcology Treatment) randomized controlled trial. *Addiction*, 103, 1474-1483.
- Sherman, S.G., Sutcliffe, C., Srirojn, B., Latkin, C.A., Aramratanna, A. & Celentano, D.D. (2009). Evaluation of a peer network intervention trial among young methamphetamine users in Chiang Mai, Thailand. *Social Science & Medicine*, 68, 69-79.
- Shelton, J.D. (2006). Confessions of a condom lover. *The Lancet*, 368, 1947-1948.
- Shuper, P.A., Joharchi, N., Irving, H. & Rehm, J. (2009). Alcohol as a correlate of unprotected sexual behavior among people living with HIV/AIDS: Review and meta-analysis. *AIDS & Behavior*, 13(6), 1021-1036. doi:10.1007/210461-009-9589-z.
- Simbayi, L.C., Kalichman, S.C., Skinner, D., Jooste, S., Cain, D., Cherry, C. et al. (2004). Theory-based HIV risk reduction counseling for sexually transmitted infection clinic patients in Cape Town, South Africa. *Sexually Transmitted Diseases*, 31(12), 727-733.
- Talbot, M. (1999). Monetary incentives in research and participation in HIV/STD risk reduction programmes. *Sexually Transmitted Infections*, 75, 1-2.
- UNAIDS (2009a). AIDS epidemic update. Geneva, Switzerland: Author.
- UNAIDS (2009b). Impact of the global financial and economic crisis on the AIDS response. Geneva, Switzerland: Author.

Review of behavioural interventions for heterosexual men

UNAIDS (2009c). Ambitious project brings key countries in eastern and southern Africa closer to 'knowing their epidemics'.

Accessed on 13th July 2010 from

http://www.unaids.org/en/KnowledgeCentre/Resources/FeatureStories/archive/2009/20090512_UNAIDS_WB_epi.asp

UNAIDS (2009d). Joint action for results: outcome framework 2009-2011. Accessed on 12 July 2010 from

http://data.unaids.org/pub/BaseDocument/2010/jc1713_joint_action_en.pdf

World bank (2010). Country Classifications. Accessed on 12th June 2010 from <http://data.worldbank.org/about/country-classifications>

Table 1. Studies that met the inclusion criteria

Authors Intervention setting	Sample characteristics	Comparison / control components	Intervention components	Assessment	EPHPP Global Rating EPHPP Weakness/es Limitations	Outcomes: Intervention effects
ANGOLA						
Bing (2008) Luanda, Angola	<u>Military personnel</u> : 568 men, aged 18- 51 years (mean: 29y), from 12 military bases	Malaria prevention (n=288): 5 daily sessions including 1- hour HIV prevention	HIV prevention (n=280): 5 daily sessions including 1-hour malaria prevention + 5 optional, monthly, 1-hour booster sessions. Based on IMB principles.	Pre- intervention, 3 & 6 month follow-ups	<u>Global</u> : Strong <u>Weakness/es</u> : None <u>Limitations</u> : Single item alcohol use measure; self-report; urban setting; short follow-up; simultaneous national HIV prevention radio programme.	Condom use : at 3m [↑]; at 6m [ns] Number of sexual partners : at 3 & 6m [ns] Alcohol use before sex: at 3 & 6m [ns]
BRAZIL						
Pechansky (2007) Porto Alegre in Southern Brazil	<u>Cocaine users</u> : 119 men, 18+ years	Standard (n=62): NIDA standard pre-& post HIV counselling	"Thought mapping" (n=57): NIDA standard pre-& post HIV counselling + thought mapping & structured stories. Grounded in transtheoretical model of health behaviour change.	Pre- intervention, 2 & 8 week follow-ups	<u>Global</u> : Weak <u>Weakness/es</u> : Pilot, quasi- experimental design; selection bias <u>Limitations</u> : Small sample size; self- referral; questionable representativeness; very short follow- up; similar control intervention.	Condom use : [↑] Number of partners : [ns]
BULGERIA						
Kelly (2006) Fakulteta, Bulgaria	<u>Impoverished</u> <u>Roma (gypsy)</u> <u>community</u> <u>members</u> : 286 men (mean	Control (26 networks; n=137): 15-minute individual counselling on HIV risk reduction	Social Network Intervention (26 networks; n=145): 15-minute individual counselling on HIV risk reduction + counselling and advice on reducing HIV risk behaviour for	Pre- intervention, 3 & 12 month follow-ups	<u>Global</u> : Strong <u>Weakness/es</u> : None <u>Limitations</u> : Questionable representativeness; small sample; self- report; modest cronbach alpha on	Condom use : with >1 partner at 3 & 6m [↑]; with casual partners at 3m & 6m [↑]; with multiple partners at 3m & 6m [↑]

	age 19.7 years) in 52 social networks		network leaders. An indigenous leader outreach model.		some psychosocial scales.	
INDIA						
Comman (2007) Chennai, India	<u>Truck drivers:</u> 250, 18+ years men	Information-only (n=125): Single, didactic HIV/AIDS prevention information workshop	Truckers' Health Project (n=125): Single, 4-hour, IMB-based group workshop. Based on IMB principles.	Pre- & post-intervention; 10- month follow-up	<u>Global:</u> Moderate <u>Weakness/es:</u> Uncontrolled confounders <u>Limitations:</u> Baseline differences between groups; no indication of refusals; 22% attrition; self-report; less engaging control condition.	Condom use: with marital partners at post-test [↑]; at 10m [↑]; with non-marital partners at post-test [ns]; at 10m [↑] Number of partners: non-marital at 10m [↓]
NIGERIA						
Exner (2009) Ibadan, Nigeria	<u>Urban community members:</u> 281, 18-73 year old men (median age: 38y)	(n=132): 1, ½-day didactic workshop	(n=149): 2, 5-hour group workshops & monthly, 2-hour check-in sessions. Based on participatory curriculum development.	Pre-intervention, 3 month follow-up	<u>Global:</u> Moderate <u>Weakness/es:</u> Quasi-experimental design <u>Limitations:</u> Small sample; non-representative sample; no indication of refusal; 33% attrition; short follow-up; self-report.	Condom use: [↑]
PHILLIPINES						
Morisky (2004) Southern Philippines	<u>Community members:</u> 3389 men, in 6 sites (mean age: 34.7y)	No expose (n=1570). [following a cross-over study design, control participants received the intervention after the intervention group]	Peer counsellor intervention (n=1819): STI/HIV/AIDS prevention, distribution of collaboratively-developed IEC materials. Based on participatory curriculum development.	Pre- & post-intervention, 6 month follow-up	<u>Global:</u> Weak <u>Weakness/es:</u> Quasi-experimental design; no assessment of confounders <u>Limitations:</u> Short follow-up; no report of blinding; self-report; self-referral; no indication of refusals	Condom use: (ever & at last sex) at post-intervention & 6m [↑]

RUSSIA						
Samet (2008) St. Petersburg, Russia	<u>Narcology hospital patients:</u> 181, 18+ year old men (75%) and women (median age: 30y),	Standard addiction treatment including HIV testing & counselling (n=87):	PREVENT (n=94): 2-session counselling including HIV testing, + 3, monthly telephone booster sessions. Based on RESPECT harm-reduction model.	Pre-intervention, 3 (by telephone) & 6 month follow-ups	<u>Global:</u> Strong <u>Weakness/es:</u> None <u>Limitations:</u> Small sample size; no indication of refusals; short follow-up; limited representativeness; self-report; social desirability bias.	Condom use: Median % of safe sex episodes (during which condoms were used) at 6 m [↑ns]; median number of safe sex episodes at 6 m [↑ns]; any condom use at 6 m [↑]
SOUTH AFRICA						
Comman (2008) KwaZulu Natal	<u>HIV-positive people:</u> 152, 18+ year old men (43%) and women (mean age: 34y) in HIV clinic care	Standard care (n=49): 2, HIV, ARV's, adherence & nutrition counselling sessions during routine clinic care every ±3 months	Izindlela Zokuphila/ Options for Health (n=103): 15-minute patient-centered discussions with counsellor during routine clinic care every ±3 months. Based on IMB principles, including motivational interviewing.	Pre-intervention, 6 month follow-up	<u>Global:</u> Moderate <u>Weakness/es:</u> Validity / reliability of assessment tools not reported <u>Limitations:</u> Single clinic; small sample; not representative of all PLWHA; self-report; short follow-up.	<u>No gender differences:</u> Condom use: [↑]
Jewkes (2008) Eastern Cape Province	<u>Rural & peri-urban community members:</u> 2776, 15-26 year old men (n=1360; >66%, 18+ years) & women in 70 villages & townships	Control intervention (35 clusters; n=1467): a single 3 hour session on HIV, safer sex & condoms	Stepping Stones (35 clusters; n=1409): 13 single-sex, 3-hour peer group sessions, 3 mixed sex meetings over 6-8 weeks. Based on adult education theory.	Pre-intervention, 1 & 2 year follow-ups	<u>Global:</u> Strong <u>Weakness/es:</u> None <u>Limitations:</u> Low session attendance; ±25% attrition; self-report; distance & parental sanction may have excluded some women; possible contamination between arms; strong control intervention; non-inclusion of adults.	<u>Men only:</u> Condom use: at 12 & 24 m [ns] Number of partners: at 12 m [↓ns]; at 24 m [ns] Problem alcohol use: at 12 m [↓]; at 24 m [ns] IPV: at 12 m [↓ns]; at 24 m [↓ns]
Kalichman (2007)	<u>Alcohol users:</u> 143 men (n=122)	HIV Education (n=74): single, 20-minute	HIV & alcohol risk reduction (n=69): single, 60-minute HIV &	Pre-intervention,	<u>Global:</u> Moderate <u>Weakness/es:</u> Participants &	<u>Controlling for gender:</u> Condom use: % in previous

Cape Town	& women, mean age 29.3y, attending a STI clinic	counselling session	alcohol risk reduction behavioural skills counselling session. Based on IMB principles.	3 & 6 month follow-ups	interventionists not blinded <u>Limitations:</u> Small sample; 34% refusal; not generalizable; $\pm 30\%$ attrition; short follow-up; self-report; different exposure times between 2 groups.	month at 3 m & 6 m [\uparrow]: at last sex at 3 m [\uparrow]; at 6 m [ns] Number of partners: in previous month at 3 & 6 m [ns] Alcohol use: in sexual contexts in previous month at 3 m [\downarrow]; at 6 m [ns]
Kalichman (2008) Cape Town	<u>Township community members:</u> 353, 18+ year old men (n=117) & women (mean: 34.1y) who drink alcohol	HIV-alcohol education (n=183): 1, 1-hour alcohol information/ education group	HIV-alcohol risk reduction (n=170): 1, 3-hour group consisting of HIV-alcohol education + motivation & behavioural skills. Based on social cognitive model of behaviour change & IMB principles.	Pre-intervention, 3 & 6 month follow-ups	<u>Global:</u> Strong <u>Weakness/es:</u> None <u>Limitations:</u> Possible contamination between intervention groups; limited generalizability; >20% attrition; self-referral; self-report; similar control intervention; different exposure times between 2 groups.	<u>No differences X gender:</u> Condom use (% , consistent & always in previous month): at 3 m [\uparrow]; at 6 m [ns] Number of partners (2+ in prior 3 m): at 3 m [\downarrow] & 6 m [ns] Alcohol use (in sexual contexts in previous month): at 3m & 6 m [\downarrow]
Kalichman (2009) Cape Town	<u>Township community members:</u> 475 (mean age: 30.2y) men	Alcohol / HIV prevention intervention (n=233): Single, 3-hour group session	Gender-based violence / HIV (GBV/HIV) prevention intervention (n=242): 5, integrated gender-based violence and HIV risk-reduction group sessions . Based on social cognitive theory & IMB principles.	Pre-intervention, 1, 3 & 6 month follow-ups	<u>Global:</u> Moderate <u>Weakness/es:</u> Selection bias <u>Limitations:</u> Quasi-experimental design; limited generalizability; no report of refusals; unrepresentativeness; short follow-up; self-report; social desirability.	Condom use: at 1m [ns]; at 3 m [\downarrow]; at 6 m [ns] Number of partners: at 1 & 3 m [ns]; at 6 m [\downarrow] Alcohol use (before sex): at 1m [\uparrow]; at 3 & 6 m [ns] GBV: (lost temper with woman) at 1m [\downarrow]; at 3 m [ns]; at 6m [\downarrow] & (hit a sex partner) at 1 & 3 m [ns]; at 6 m [\downarrow]

Simbayi (2004) Cape Town	<u>STI clinic patients:</u> 228 men (n=151) & women with repeat STD diagnoses (mean age: 27.5 years)	Single, 20-minute, didactic HIV information / education session (n=114)	Single, 60-minute, HIV information / education, motivational, & communication skills-building session (n=114). Based on IMB model.	Pre- intervention, 1 & 3 month follow-ups	<u>Global:</u> Moderate <u>Weakness/es:</u> Validity / reliability of assessment tools not reported <u>Limitations:</u> Small sample; short follow- up; limited generalizability; self-report; different exposure times between 2 groups; no indication of blinding.	<u>Controlling for gender:</u> Condom use: at 3 m [↑] Number of sexual partners: at 3 m [ns]
THAILAND						
Latkin (2009) Chiang Mai, Thailand (& Philadelphia, U.S.A.)	<u>Injecting drug users:</u> (Thailand only) 427 men (84%; n=357) & women recruited by 182 eligible network indexes	Individual HIV testing & counselling (n=213 including 91 indexes) with risk reduction counselling at each follow-up	Peer education (n=214, + 91 indexes): Individual HIV testing & counselling with risk reduction counselling at each follow-up + 6, 2-hour group peer educator sessions + 2 booster sessions to indexes only. Based on peer education principles.	Pre- intervention, 6, 12, 18, 24 & 30 month follow-ups	<u>Global:</u> Moderate <u>Weakness/es:</u> Validity / reliability of assessment tools not reported <u>Limitations:</u> Possible contamination between groups; government “war on drugs” policy; self-report; social desirability; possible self-selection bias	<u>In Thailand only:</u> Condom use: with non-primary partner (past week), any partner (past week) at 30 m [ns] Number of partners: (past month) at 30 m [ns]
Sherman (2009) Chiang Mai, Thailand	<u>Methamphetamine users:</u> 983 men (75%) & women, 18-25 years (median age 19y),	Life skills (n=488 including 206 indexes): 7, 2-hour, bi-weekly, small group sessions for indexes only	Peer education (n=495 including 209 indexes): 7, 2-hour, bi-weekly, small group sessions + 2 booster sessions for indexes only. Based on peer education principles.	Pre- intervention, 3, 6, 9 & 12 month follow- ups	<u>Global:</u> Moderate <u>Weakness/es:</u> Validity/reliability of assessment tools not reported <u>Limitations:</u> Non-random sampling / recruitment; similar control intervention; self-report; low numbers attending all sessions; possible contamination between groups; government policy of “war on drugs”.	<u>No differences by gender:</u> Condom use: (always in past 3 months) [ns]
UGANDA						

Kajubi (2005) Kampala, Uganda	<u>Peri-urban community members:</u> 498, 18-30 year old men residing in 2 peri-urban communities	Comparison (n=201): increase condom availability & brief AIDS informational presentation	Condom promotion (n=297): increase condom availability & 1 of 8, 3-hour technical use condom skills workshops.	Pre-intervention & 6-month follow-up	<u>Global:</u> Moderate <u>Weakness/es:</u> Reliability / validity of assessment tool not reported <u>Limitations:</u> only 2 communities; $\pm 23\%$ attrition; unknown non-attendance; possible contamination; short follow-up; self-report.	Condom use: any partner [ns] & casual partners [ns] Number of partners: any partners & casual partners [↑]
Kamali (2003) Masaka district in SW Uganda	<u>Rural community members:</u> ± 15000 men (45%) & women, 13+ years ($\pm 75\%$ were 20+ years) in 18 communities	Comparison: Routine government health services & community development activities (6 communities; n=6742)	1) IEC: Information, education & community activities (6 communities; n=6918) 2) IEC & STI: Information, education & community activities + improved STI management (6 communities; n=6856). Based on IEC model of behaviour change & social marketing.	Pre-intervention, 2 follow-ups during a median of 3.6 years	<u>Global:</u> Strong <u>Weakness/es:</u> None <u>Limitations:</u> Self-report; possible social desirability; possible contamination between intervention communities; mature, stabilizing HIV epidemic;	<u>No differences by gender:</u> <u>IEC vs. comparison:</u> Condom use: with last casual partner [↑ns] Number of partners: 2+ in past year [ns] <u>IEC & STI vs. comparison:</u> Condom use: with last casual partner [↑] Number of partners: 2+ in past year [ns]
UKRAINE						
Booth (2009) Kiev, Odessa & Makeevka/Donesk, Ukraine	<u>Injecting drug users:</u> 1798 (76% men), 18+ years (mean: 29.5y)	HIV counseling & education (C&E) (n=900): pre- & post test HIV counselling	Indigenous leader outreach model (ILOM) (n=898): HIV counseling & education + individualized risk reduction over 5m by outreach workers. Based on peer education principles.	Pre-intervention, 6 month follow-up	<u>Global:</u> Moderate <u>Weakness/es:</u> Cross-over experimental study design <u>Limitations:</u> Self-report; non-blinded participants; short follow-up; questionable representativeness	Condom use: in the past 30 days [ns] Number of partners: in the past 30 days [ns]
ZIMBABWE						

Gregson (2007) Manicaland Province, Eastern Zimbabwe	<u>Rural community members:</u> 11980 men aged 17-54 & women aged 15-44 residing in 12 communities (from a population-based, closed cohort survey)	Standard Government services (46%=male): syndromic STI management, condom distribution and social marketing, home based care, limited HIV-focused IEC activities	Interventions (45%=male): Community & clinic-based: workplace & community peer education; condom distribution among CSW & clients; income-generating projects for women; strengthening management of STIs & health center open-days. Based on peer education principles & included IEC model of behaviour change.	Pre-intervention, 3 year follow-up	<u>Global:</u> Moderate <u>Weakness/es:</u> High dropout/withdrawal <u>Limitations:</u> 45% attrition (2 nd follow-up); possible contamination between intervention communities; co-intervention in some sites; negative role-modelling of peer educators; mature, stabilizing HV epidemic; self-report.	<u>Men only:</u> Condom use: [ns]; with casual partners [↑]; with regular partners [ns] Number of partners: multiple new partners in past year [ns]; >2 regular partners in past 3 years [↓]; multiple casual partners in past 3 years [ns]
---	---	--	---	------------------------------------	---	---

[↓] p<0.05 Statistically significant decrease in biological / behavioural outcome compared to control/comparison group

[↓ns] p<0.10 Suggesting a decrease in biological / behavioural outcome compared to control/comparison group

[↑] p<0.05 Statistically significant increase in biological / behavioural outcome compared to control/comparison group

[↑ns] p<0.10 Suggesting an increase in biological / behavioural outcome compared to control/comparison group

[ns] no statistically significant difference between intervention and control/comparison group

EPHPP: Effective public health practice project; m: month/s; IPV: Intimate partner violence; GBV: gender-based violence; IMB: Information-motivation-behaviour skills; IEC: Information-education-communication

Chapter 3: CONCLUSIONS, LIMITATIONS AND FUTURE DIRECTIONS

1. SECOND GENERATION HIV SURVEILLANCE AMONG HETEROSEXUAL MEN

Three BBSS and a qualitative inquiry among HRH men were conducted in 2006 and 2008 to develop an effective method of second generation HIV surveillance among heterosexual adult men who have multiple, concurrent female sexual partners. Chapter 1 provides a rationale for conducting the BBSS in peri-urban, informal settings based on findings from previous national household survey data that characterized these settings as high HIV risk geographic areas in South Africa. It is in these areas too that unemployment levels are high and poverty is widespread. In many respects these settings mirror those targeted for repeat cross-sectional HIV surveillance by the National HIV Behavioral surveillance System (NHBS) in 25 cities in the USA (Denning & DiNenno, 2009). As in this thesis, the NHBS aims to develop an ongoing behavioural surveillance system to determine the prevalence of, and trends in HIV risk behaviours among selected subpopulations at high risk for HIV in the USA. This initiative identified one such subpopulation as heterosexuals (the others are MSMs, and IDUs). In the USA this undertaking was prompted by concerns over the possibility of generalized HIV epidemics emerging in poverty areas of the USA. In this thesis the concern was over the possible influence that heterosexual men who have multiple, concurrent partners have on the continuing, high levels of HIV in South Africa. In both South Africa and the USA, the primary objectives of on-going BBSS is to gain a deeper understanding of high risk behaviour/s among high risk subpopulations related to HIV infection. The BBSS in both the USA and South Africa have used RDS to sample their respective high-risk subpopulations.

Preliminary findings from 23 of the 25 cities in the NHBS-HET-1 show that HIV prevalence (2.1%) is 20 times greater than among heterosexuals in the general USA population (0.1%); the majority of people in the surveys are minority populations (African American (77%) and Hispanic (15%)), many are unemployed (39%), and poverty levels are high with 75 % of people having an income at or below the poverty threshold (Denning & DiNenno, 2009). Remarkably similar are the findings from the three BBSS that inform this thesis: HIV prevalence among study participants (12.3% in 2006, and 15.2% in 2008 in Khayelitsha, and

14% in Khayamandi in 2008) was considerably higher than the provincial proportions (2.7% in 2005 and 5.4% in 2008); all of the men in the study settings were previously disadvantaged “black” Africans; and unemployment and poverty levels remained high over the two data collection periods and across settings.

2. HIV RISK BEHAVIOURS AMONG HETEROSEXUAL MEN

Published findings from NHBS-HET-1 cities suggest that heterosexuals in poverty areas engage in high HIV-related risk behaviours, mirroring those found among HRH men in the three BBSS conducted in South Africa, and reported in the papers that comprise Chapter 2 of this thesis. In these three BBSS approximately 96% of men reported concurrent sexual partnerships; men reported large numbers of sexual partners (although this seemed to be decreasing over time); and condom use was inconsistent with all partner types (although appearing to be increasing over time). In the NHBS-HET-1 conducted in Houston, men reported an average of 6.1 sexual partners and women 5.2 sexual partners in the past 12 months, and half of participants reported not using a condom at last sex with their casual partners (Risser & Padgett, 2007). Almost half of women in this city’s sample (49%) reported concurrent sexual partnerships in the previous 12 months; and only 26% reported condom use at last sex (Richards, Risser, Padgett, Rehman, Wolverton & Arafat, 2008). An average of 10.7 sexual partners in the past 12 months was reported among heterosexuals in the NHBS-HET-1 conducted in New York City. In this city more than two-thirds (67.5%) of participants reported concurrent partnerships (71.6% among men and 63.7% among women); 79% reported not using a condom with their most recent sexual partner; and 80% suspected that their partners had other sexual partners (Neaigus et al., 2009). In San Francisco, 37% of men and 35% of women reported concurrent sexual partners in the past 12 months (Arnold, Fisher & McFarland, 2010) and in Washington D.C., 53% of men and 40.3% of women reported having concurrent sexual partners in the past 12 months; 46% suspected partner infidelity; and 71% had not used a condom at last sex (Magnus et al., 2009).

There are no studies in South Africa that have been conducted among men who have multiple, concurrent partners, and thus comparable findings are not available. The South African national population survey conducted by the Human Sciences Research Council

(Shisana et al., 2009) measured multiple sexual partnering as more than one sexual partner in the past 12 months, but there is no indication of whether and how many of these partnerships were concurrent. This survey found that among the general population, having more than one sexual partner in the past 12 months has increased steadily among men between 15 and 49 years since 2002: from 9.4% in 2002, to 17.9% in 2005 and 19.3% in 2008. If the majority of these people are also engaging in concurrent sexual partnerships as was found in the three BBSS that inform this thesis and the studies in the USA (albeit to a lesser extent), then concerted efforts need to be made to target this high risk behaviour with HIV prevention interventions. Monitoring trends in this behaviour will also be essential in determining whether prevention strategies are successful or not.

The parallel findings from the USA confirm that HRH men are a subpopulation at high risk of HIV infection and transmission and are thus appropriately targeted for repeated BBSS. In South Africa findings from repeated BBSS among HRH subpopulations will inform intervention strategies and policies, and will also provide evidence-based accountability to HIV funders, trend analysis, and evaluation of existing prevention programmes. As results from further rounds of NHBS-HET-1 are forthcoming in the USA, there is no doubt that these will be used similarly.

3. THE RELATIONSHIP BETWEEN RISK BEHAVIOURS AND HIV

Each of the papers that comprise Chapter 2 provides a description of the relationship between risk behaviours and HRH men's, and by extension their female sexual partners', vulnerability to HIV infection and transmission. While the previous section – "HIV risk behaviours among heterosexual men" - has compared the findings from the studies that comprise this thesis to the only known studies among HRH people. The published papers in Chapter 2 discuss each individual paper's results in relation to other local and international findings and will not be repeated here. However, a common theme in the interpretation of the individual papers' findings can be identified and will be used to suggest a conceptual framework, depicted in Figure 2. The conceptual framework proposes the interrelationship between risky sexual behaviours among men who have multiple sexual partners investigated in the three BBSS and qualitative study that inform this thesis. It also draws on

the framework proposed in Paper 5 in Chapter 2 and Jewkes' model that depicts the causal pathways of IPV (Jewkes, 2002). The common theme concerns the inextricable interconnection between HIV risk behaviours and a model of dominant masculinity prevalent among many South African men.

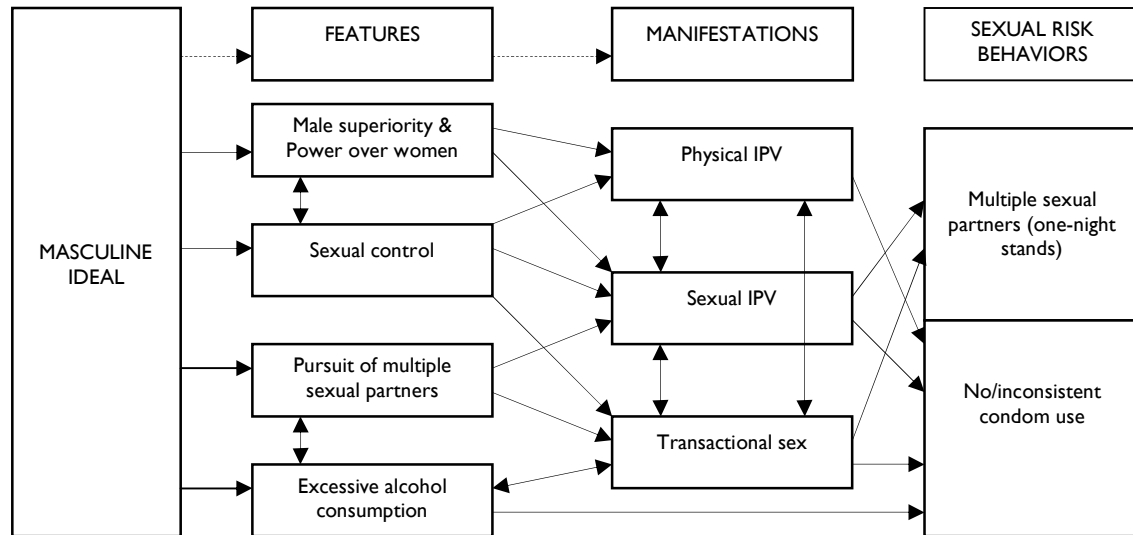


Figure 2. Features and manifestations of a model of masculinity that influences risky sexual behaviours among men who have multiple sexual partners

This model of masculinity emphasizes male superiority, and power and control over women. Within this masculine ideal, men are often compelled to overtly demonstrate (sexual) control over and “success” with women. This in turn leads to the pursuit of multiple sexual partners as a means to enhance men’s esteem among their peers. It also leads to men’s control over, and decisions about safe sex, including condom use. The practice of transactional sex, often involving alcohol in the mechanics of the exchange, fuels both the pursuit of multiple sexual relationships (commonly one-night stands), inconsistent and/or non-condom use, and the possibility of IPV perpetration. The already unequal gendered power dynamics that characterise heterosexual relationships are exacerbated by the paying partner’s perceived “right” to control sexual encounters in whatever way he chooses. This “right” often involves sexual coercion, physical IPV and non-condom use. Another feature of the model of masculinity is excessive alcohol use, particularly prevalent among men who have multiple sexual partners and their peers. Once the disinhibitive effect of and impaired

judgement associated with alcohol is included in this cluster of risk behaviours, we have situations where the risk of HIV transmission and acquisition is compounded.

4. EVIDENCE FROM BBSS FOR TARGETED HIV PREVENTION INTERVENTIONS

While regular, repeated BBSS among heterosexuals will provide invaluable information about HIV epidemic dynamics in South Africa and globally, another important function of such information is the direction it can provide for targeted HIV prevention interventions among high-risk subpopulations. While Abdool Karim suggests that our failure to reduce HIV in sub-Saharan Africa reflects our failure to curb infection among (young) women in the region (Abdool Karim et al., 2010), this failure may have as much to do with the limited number of focused interventions for heterosexual men (Exner, Gardos, Seal & Ehrhardt, 1999) in low- and middle-income developing countries (McCoy, Kangwende & Padian, 2010). Exner and colleagues went on to suggest that “heterosexually active men be included in strategic efforts to reduce heterosexual transmission because sexual behavior is dyadic and men are the [sexual] partners of women” (Exner et al., 1999: p. 348).

Each of the papers contained in Chapter 2 provides suggestions for appropriate HIV prevention interventions based on the findings. In sum, because men who have multiple partners socialize in close-knit groups, it may be appropriate to implement interventions among groups of peers. Another possibility could be a peer opinion leader format where leaders within close-knit groups are targeted for behaviour change and dissemination of such change to their peers. An intriguing example would be a designated “sober buddy” among the group whose responsibility could be to ensure that the members of his group are equipped with condoms when drinking at shebeens and pursuing women for sex. The conceptual model above suggests that men should be encouraged to confront and change their ideal of masculinity, which must include promotion of equitable gender relations. Reduction of IPV, excessive alcohol consumption, sexual control and the pursuit of one-night stands may be directly targeted or may be a spin-off of such a confrontation. Given that men who have multiple sexual partners spend a great deal of their leisure time in shebeens and taverns, shebeen-based interventions may be appropriate. That being said, an obvious structural intervention should work towards providing men with alternative

(healthier) leisure outlets. Finally, given that heterosexual is by definition a dyadic relationship, interventionists might attempt to conduct intervention sessions comprising both men and women (irrespective of whether the women are the men's female partners) so that both members of the heterosexual dyads are equally informed as to the goals of the intervention.

Evidence from BBSS among heterosexual men will go a long way in informing prevention efforts among them and create a much needed greater male responsibility in curbing HIV transmission (Abdool Karim et al., 2010). There is some promise too for the use of RDS to recruit HRH men who are not easily accessible for prevention efforts. Recruitment coupon numbers, coupled with some form of biometric data (an example of which is finger print scans used in Uganda (Hladik, 2009)), has the potential for following up men for post-intervention assessments; an essential element in HIV prevention programme evaluation.

5. CHALLENGES IN COLLECTING SEXUAL BEHAVIOUR DATA

Having provided a strong argument for regular BBSS among HRH subpopulations, it should be noted that asking people sensitive questions about sexual behaviour is not without challenges that can impact on the validity of self-reported data. It is essential that those developing and/or administering behavioural surveys are fully conversant with these challenges in order to attempt to overcome them or, at the very least, account for them when interpreting findings from BBSS. These challenges include self-preservation bias, social desirability bias, and recall bias that impact on the accuracy of the information thus obtained. Before detailing each of these challenges, it should be noted that at the stage of behavioural questionnaire construction, strategies to assess that each question measures what is intended, is an essential validation procedure. In this respect questionnaire developers should be cognisant of relevant cognitive research that provides vital information about respondents' comprehension, recall and retrieval abilities (Brenner, Billy & Grady, 2003). Formative research among potential participants and thorough piloting of questionnaires is highly recommended.

5.1. Self-preservation bias

Given the nature of such an intensely private aspect of human behaviour, variability in responses about sexual behaviour/s often depends on prevalent cultural and social norms. In some instances, where particular behaviours are negatively sanctioned or taboo, people may be inclined to under-report. On the other hand, where behaviours are positively sanctioned or deemed to reflect some underlying “strength”, people may over-report. An example from the three BBSS that inform this thesis is the possible perception among men that having multiple sexual partners is a behaviour admired by fellow men. In this instance, men in the BBSS may have over-reported this behaviour, particularly as the questions were asked face-to-face, by men. Closely tied to the issue of self-preservation is the issue of social desirability.

5.2. Social desirability

People are often motivated to answer questions less truthfully or accurately than is the case should they wish to be polite, avoid criticism or seek praise, or from embarrassment (Turner et al., 2009). Almost 80% of women participating in a microbicide trial in South Africa reported providing false or misleading information during face-to-face interviews and cited the above motivations for doing so.

Another study among youth and young adults in the USA also found discrepant reporting of consistent condom use against a biomarker: a Y-chromosome polymerase chain reaction (Yc-PCR) assay which detected Y-chromosome DNA of sperm in vaginal fluid (Rose et al., 2009) in more than a third of cases. While these authors suggest that incorrect condom use may be largely responsible for these discrepancies, it is possible that social desirability may have also been responsible. In contexts where HIV prevention messages that inform people about safe sex behaviours are abundant locally and nationally, people may be motivated to provide answers concordant with these messages rather than those that reflect their reality. However, not all inaccurate reporting of sexual behaviour can be attributed to self-preservation and social desirability, and may also have to do with people’s inability to recall aspects of their sexual behaviours accurately.

5.3. Recall bias

Some of the questions in sexual behaviour assessments typically require a detail of retrospective recall that is often beyond individual participants' recall ability, and will also depend on the frequency of the behaviour/s in question during the stipulated timeframe. A meta-analysis of 28 studies that examined test-retest reliability of three recall periods: 1, 3 and 6 months found that the recall period for sexual behaviours that produced the most reliable data was 3 months, and for numbers of sexual partners was 6 months (Napper, Fisher, Reynolds & Johnson, 2010). However, these studies were conducted with USA and Australian samples and the reviewers conclude that, given the little prior consensus on the most favourable recall periods, further assessment of optimal recall periods is needed.

5.4. Modes of questionnaire administration

In an attempt to mitigate many of these shortcomings of self-report in sexual behavioural research, different methods of questioning have been used in an attempt to maximize participants' privacy and anonymity. Many of the challenges outlined above are a feature of face-to-face interviews (FTFI). While self-administered questionnaires (SAQ) may overcome many of the problems inherent in FTFI, low literacy among participants will preclude this method in some instances. Further, missing responses in SAQ provide no indication of whether participants refused to answer, whether some questions were misunderstood, whether participants simply skipped the question/s or were confused by skip patterns (Langhaug, Sherr & Cowan, 2010; Phillips, Gomez, Boily & Garnett, 2010).

Audio computer-assisted self-interviewing (ACASI) and other electronic questionnaire administration methods are increasingly being used in sexual behaviour research. While these methods are thought to increase participants' privacy and anonymity and thus the accuracy of responses, there is no consensus in the literature to date as to the relative efficacy of this method over others. Two recent reviews of interviewing tools (Phillips et al., 2010) and questionnaire delivery modes (Langhaug et al., 2010) in low- and middle-income countries sought to assess the utility of electronic modes of administration relative to other means. In the first-mentioned review, the authors concluded that non-interviewer administered methods of quantitative data collection were not necessarily superior to FTFI

(Phillips et al., 2010) and depended on the nature of the behaviour being enquired about. In the second-mentioned review, also using studies in low-income developing countries, the authors concluded that compared to other methods, ACASI can reduce reporting bias substantially (Langhaug et al., 2010). Their evidence suggested that, when compared to other questionnaire administration modes, ACASI decreased non-response rates and increased rates of reporting on sexual behaviours. ACASI was also found to be acceptable, easy to use and reportedly raised levels of comfort in reporting (Langhaug et al., 2010).

5.5. Validation of sexual behaviour question responses

Validation of responses to sexual behaviour questions using biomarkers is one way to assess the reliability of self-report and perhaps to promote more accurate reporting if participants are aware of the validation procedure. However, taking biological specimens for validation purposes alone raises ethical concerns and is also expensive (Rose et al., 2009). This last challenge may preclude this method in resource-constrained settings. Another method of validation may be to introduce follow-up questions about some behavioural questions (Lipovsek, Longfield & Buszin, 2010). These authors used data from 11 datasets that used this method for questions about consistent and correct condom use to assess the impact of follow-up questions on the accuracy of reporting. Follow-up questions were found to substantially reduce the number of people reporting consistent condom use thus improving the estimates of consistent condom use (Lipovsek et al., 2010).

5.6. Conclusion

The limitations of self-report in sexual behavioural surveys described above are endemic to all such surveys. Despite these limitations there is no other means to collect such information and researchers should attempt to eliminate or mitigate these limitations as best they can. It would appear that computer technology may be well-placed to increase people's perceptions of privacy and anonymity; these being the major stumbling blocks for honest responses. The findings suggest that even in resource-constrained settings and among people unfamiliar with computing, this technology offers some means of overcoming response biases. Questionnaire developers should also heed the finding that shorter recall periods (3 or 6 months depending on the behaviour being asked about) are likely to elicit the

most optimal recall and implement such recall strategies to try to mitigate recall bias as much as possible. Repeat questioning may also be a way in which to validate responses, but should not be over-extensive as people may react negatively to such repeated enquiries. Resources permitted and ethical concerns aside, biomarkers may be used to validate some behavioural responses. However, biomarkers such as the Yc-PCR assay described above, can only be used among women; and biomarkers for men are lacking.

6. LIMITATIONS OF RDS

Details of the limitations of other sampling and recruitment methods for hard-to-reach, high risk subpopulations have been outlined in Chapter 1. These limitations have been largely instrumental in the emergence and popularity of RDS as a means to access hard-to-reach populations for BBSS internationally. As RDS is increasingly being viewed as a panacea for the ills of other sampling methods for hard-to-reach subpopulations, it is vital that researchers planning to use it are aware that RDS is not without its own analytical, procedural and operational limitations.

6.1. Analytical limitations

Recent literature has begun to question the empirical validity of the RDS methodology (Gile & Handcock, 2009; Goal & Salganik, 2009; Lu, Bengtsson, Britton, Camitz, Jun Kim, Thorson & Liljeros, 2010) and largely revolve around the assumptions that must be met in order for RDS to generate a probability sample with unbiased population estimates (Gile & Handcock, 2009; Heckathorn, 2007; Lu et al., 2010). Many of these assumptions are not reflected in “real” networks and recruiting behaviour (Lu et al., 2010). The first assumption, reciprocity, is that people in the population under study maintain and recruit their peers through reciprocal relationships. In reality however, many people do not have strong reciprocal relationships with all the members of their social networks and relationships are often marked by varying degrees of reciprocity. In fact, weak social ties, for example where a person merely knows someone well enough to invite them to participate in a survey, is sufficient to meet the assumption of reciprocity (Sabin, personal communication). Second, connectedness refers to the chance of each person in the population of interest being invited to participate. However, in order for this assumption to be met, all people irrespective of the

social network to which they belong, should be connected in some way. In reality, this is most often not the case. The third assumption, sampling with replacement, does not occur in RDS. People are only permitted to participate once, thus sampling is not with replacement (Gile & Handcock, 2009). Lu et al (2010) found in their simulation study that under circumstances of sampling without replacement, the RDS estimators were biased in different directions in different networks. However, despite this critique of this RDS assumption, there are instances where the sample can be treated as “with replacement” because each recruiter’s social network is an independent population from which s/he may recruit peers into a survey (Sabin, personal communication). These instances include when the population is large enough, the sample proportionally small enough, and the networks are reached into far enough. Fourth, participants need to have accurate knowledge about the size of their network of peers who resemble them on the study eligibility criteria, i.e. their network degree. Such accuracy is questionable particularly when the study criteria are quite specific or call for some knowledge of peers’ behaviour that may not be known. Fifth the assumption that recruitment of peers occurs in a random manner from within the recruiters’ personal social network is often not the case. People usually recruit others from their social networks with whom they have a close relationship (Gile & Handcock, 2009).

Finally, the software currently used to analyze data collected by means of RDS, RDSAT, is limited in its ability to produce anything more than proportion estimates (including confidence intervals), and output on homophily, average network sizes and equilibrium (Johnston et al., 2008). While it is true that surveillance data is most often used to provide descriptive information for their respective samples, and thus there is little need for more sophisticated, multivariate analysis, often such analysis is extremely useful to assess predictors of HIV, other STIs and risk behaviours. However, there is no agreed upon method by which to use the RDS-generated weighting in multivariate analysis (Johnston et al., 2008).

Despite the limitations of RDS methodology, it is currently believed to be the most robust method by which to access hard-to-reach populations that reach far into the population of interest, and is less likely to miss some members of the population (Wejnert, 2009). While the

analytical limitations of RDS are substantial and will depend on the level of violation of the underlying analytical assumptions, sexual behaviour researchers using RDS should use evidence and lessons learned from other studies conducted in their respective settings to design their studies and data collection methods optimally. At the least, they should also be aware of, and report these shortcomings and the possible impacts they may have had on the accuracy of the data obtained.

6.2. Incentives

RDS relies on a dual incentive system to encourage participation and recruitment. These dual incentives are used to cultivate long referral chains so that the influence of the original recruiter (the seed) is overcome (Semaan, Santibanez, Garfein, Heckathorn & Des Jarlais, 2009). While incentives also increase the probability of reaching one's sample size in as short a time as possible, they do have the potential to bias participation largely due to the way in which they can impact on participants' motivations to participate (Semaan et al., 2009). First, incentives that are too large will encourage attempts to participate in a study more than once and may encourage participants to be dishonest about their eligibility in order to participate. Large incentives can also cause coupon bartering and selling (Scott, 2008), and recruitment that is too fast for study staff to cope with (Johnston, Malekinejad, Kendall, Iuppa & Rutherford, 2008). Second, incentives that are too small may discourage participation, or result in slow recruitment (Johnston et al., 2008). Small incentives may encourage only those for whom the small incentive is adequate, namely poor and/or unemployed people, thus introducing a bias in the sample based on socio-economic or employment status. The setting of the appropriate value and form of incentives can thus not be underestimated and should be investigated thoroughly during formative research prior to each surveillance study (Johnston et al., 2010). Third, there has been concern expressed about the potential for coercion that recruiters may exert on their peers (Semaan et al., 2009, Scott, 2007). During RDS, recruitment of participants is not in the hands of the researchers who are bound by ethical principals that operate to protect the well-being of participants. Concerns over recruiters not being bound by these ethical principals have been raised (Scott, 2008). Fourth, the presence of incentives in study sites raises security issues particularly if the study site is situated in an area where the crime rate is high. Fifth, among some subpopulations

incentives or their equivalent exchange value may encourage participants to use them for undesirable means and such as to purchase drugs, alcohol or pay for exchange sex (Semaan et al., 2009, Scott, 2007). Many of these potential problems can be anticipated and resolved through formative research conducted in the study site among potential participants prior to study initiation (Johnston et al., 2010) as well as the employment of security guards in the study site. This last strategy was employed in all of the BBSS that inform this thesis and, while we were not able to monitor what was occurring among participants outside the immediate environs of the study settings, we were able to restrict many of these potential problems in and around the study sites. However, as there seems to be a move towards conducting BBSS using RDS in settings characterized by poverty, the issue of incentives and their potential harm to participants is important and should be considered thoroughly.

6.3. Recruitment coupon numbers

The way in which recruitment coupons are numbered so that participation and recruitment patterns can be monitored is described in Chapter 1. While some studies have used different methods of achieving these aims, it is worth noting that the numbering system described in Chapter 1 and used in many settings is cumbersome and open to human error, particularly as waves of recruitment and thus digits in the coupon numbers increases over time. In order to link questionnaire responses to biological samples and other study documents, recruitment numbers are transferred by hand onto each of these. Consider a recruitment coupon number after 17 waves of recruitment such as this: 8.2.2.3.1.3.1.3.2.1.1.3.3.1.1.1.1. The chance of inaccuracy when copying these numbers repeatedly, by different field staff, is great and can impact significantly on linking questionnaire data to biological samples, as well as linking people in follow-up cohort studies. Electronic bar-coded stickers that contain the recruitment coupon numbers and are reproduced in sufficient quantity to be attached to all study forms and biological specimens overcomes this major challenge, and should be integrated into future RDS studies.

7. STRENGTHS AND LIMITATIONS OF BBSS STUDIES IN KHAYELITSHA AND KHAYAMANDI

The BBSS conducted in 2006 was the first known surveillance study to be conducted among a HRH subpopulation of adult males that had not previously been defined as a MARP. The findings provided important, initial insight into the high-risk behaviours of HRH men who had multiple sexual partners and were used to inform the development of an HIV risk-reduction intervention specifically targeting these men's risk behaviours. The follow-up BBSS in the same study community in 2008 allowed an assessment of the feasibility of RDS to continue to recruit HRH men in on-going, regular BBSS among them. The findings allowed for a comparison of risk behaviours over time and an initial, albeit tentative, examination of and explanation for changes in behaviour between the two time points. The BBSS conducted in a similar high-risk community among similar HRH men in 2008 enabled an examination of high-risk behaviour among the same subpopulation in a different setting. Using RDS for BBSS among HRH was found to be successful and feasible, thus paving the way for future BBS among this, similar and other high-risk subpopulations.

Together these BBSS have addressed the central aim of this thesis: to develop an effective method of second generation HIV surveillance among heterosexual adult men residing in peri-urban, informal settings who have multiple, concurrent female sexual partners, and to examine HIV-related risk behaviours and HIV prevalence among them over time and across settings. Furthermore, and importantly, the BBSS provide an essential evidence-base for greater accountability to HIV funders (locally and internationally), and for more effective use of national and international resources for HIV prevention programmes. Evidence from a focus on South Africa confirms that BBSS among HRH men who have multiple sexual partners is necessary and timely if the country is to make any impact on the persistently high levels of HIV.

The limitations and challenges of behavioural surveillance and of RDS outlined above are equally pertinent to the three BBSS that inform this thesis. However, they are arguably endemic to any BBSS that uses RDS among any high-risk subpopulation. Every effort was

made to address these challenges outlined in each of the papers that comprise Chapter 2, and therefore not repeated here.

8. FUTURE DIRECTIONS

Repeated BBSS among HRH and other HR subpopulations are vitally important for an accountable and evidence-based response to the HIV epidemic in South Africa. Repeated BBSS among HRH women is an important future direction for second generation HIV surveillance. Risk similarities or differences between HRH men and women can be considered with such data, and efforts can begin to map sexual networks that could form the focus of dual-gendered intervention efforts. With biomedical HIV prevention modalities still in their infancy, prevention efforts must focus on changing (risky) human behaviour (Brock & Wikler, 2008; Global HIV Prevention Working Group (2008). Information from repeated BBSS among high-risk subpopulations will amass reliable evidence-based information about HIV prevalence and HIV-related risk behaviours. Prevention intervention practitioners and policy makers could use this information to make informed decisions about implementation of behavioural prevention interventions that have been shown to work, and relinquish or modify those that have had limited or no effect. More importantly, resource-constrained countries need to invest the limited prevention resources on behaviours that are driving the epidemic, and among the people who are engaging in those behaviours. For many low- and middle-income countries, where HIV prevalence is highest (for example, in sub-Saharan Africa where 71% of all new HIV infections occurred in 2008 (UNAIDS, 2009a)), one such group of people is heterosexual men who have multiple, concurrent sexual partners.

REFERENCES (Chapters 1 and 3)

Abdool Karim, S. & Abdool Karim, Q. (2010). AIDS research must link to local policy. *Nature*, 463, 733-734.

Abdool Karim, S.S., Abdool Karim Q., Gouws, E. & Baxter, C. (2007). Global epidemiology of HIV-AIDS. *Infectious Disease Clinics of North America*, 21, 1-17.

Abdool Karim, Q., Sibeko, S. & Baxter, C. (2010). Preventing HIV infection in women: a global health imperative. *Clinical Infectious Diseases*, 50(S3), S122-S129.

AIDS Support and Technical Assistance Resources Project (AIDSTAR) (2009). Addressing multiple and concurrent sexual partnerships in generalized epidemics. USAID:

Arnold, M.P., Fisher, H.R. & McFarland, W (2009). Socioeconomic position and HIV risk-relevant behavior among lower-income heterosexuals in San Francisco. *AIDS & Behavior*. doi:10.1007/s10461-009-9665-4.

Baliunas, D., Rehm, J., Irving, H. & Shuper, P. (2010). Alcohol consumption and risk of incident human immunodeficiency virus infection: a meta-analysis. *International Journal of Public Health*, 55, 159-166.

Boulle, A., Hilderbrand, K., Menten, J., Coetzee, D., Ford, N., Matthys F. et al., (2007). Exploring HIV risk perceptions and behaviour in the context of antiretroviral treatment: results from a township household survey. *AIDS Care*, 20(7), 771-781.

Brady, N.D., Billy, J.O.G. & Grady, W.R. (2003). Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: evidence from scientific literature. *Journal of Adolescent Health*, 33, 436-457.

Casswell, S. & Thamarangsi, T. (2009). Reducing harm from alcohol: call to action. *The Lancet*, 373, 2246-2257.

Centers for Disease Control and Prevention (2009). Overview of public health surveillance. Conference proceedings from the Second Global HIV/AIDS Surveillance Meeting, Bangkok 2-5 March 2009. Accessed on 23 July 2010 from <http://www.hivsurveillance2009.org.index.html>.

Colvin, M., Abdool Karim S.S., Connolly, C., Hoosen, A.A. & Ntuli, N. (1998). HIV infection and asymptomatic sexually transmitted infections in a rural South African community. *International Journal of STD & AIDS*, 9, 548-550.

Common Ground Holdings and Neville Naidoo and Associates (2006). *Social survey 2005: Stellenbosch Municipality (WC24)*. Unpublished report compiled for Stellenbosch Municipality.

Cook, R.L. & Clark, D.B. (2005). Is there an association between alcohol consumption and sexually transmitted diseases? A systematic Review. *Sexually Transmitted Diseases*, 32, 156-164.

Denning, P & DiNenno E. (2010). Communities in crisis: Is there a generalized HIV epidemic in impoverished urban areas of the United States? Centres for Disease Control & Prevention. Accessed on 30th July 2010 from http://www.cdc.gov/hiv/topics/surveillance/resources/other/pdf/poverty_poster.pdf

Diaz, T., Garcia-Calleja, J.M., Ghys, P. & Sabin, K. (2009). Advances and future directions in HIV surveillance in low- and middle income countries. *Current Opinion in HIV and AIDS*, 4, 253-259.

Dunkle, K.L. & Jewkes, R. (2007). Effective HIV prevention requires gender-transformative work with men. *Sexually Transmitted Infections*, 83, 173-174.

Dunkle, K.L., Jewkes, R.K., Brown, H.C., Gray, G.E., McIntyre, J.A. and Harlow, S.D. (2004a). Gender-based violence, relationship power, and risk of HIV infection in women attending antenatal clinics in South Africa. *The Lancet*, 363, 1415-1420.

Dunkle, K.L., Jewkes, R.K., Brown, H.C., Yoshihama, M., Gray, G.E., McIntyre, J.A. et al. (2004b). Prevalence and patterns of gender-based violence and revictimization among women attending antenatal clinics in Soweto, South Africa. *American Journal of Epidemiology*, 160, 230-239.

Dunkle, K.L., Jewkes, R.K., Nduna, M., Levin, J., Jama, N., Khuzwayo, N., Koss, M.P. & Duvvury, N. (2006). Perpetration of partner violence and HIV risk behaviour among young men in the rural Eastern Cape, South Africa. *AIDS*, 20, 1-8.

Dworkin, S.L., Fullilove, R.E. & Peacock D. (2009). Are HIV/AIDS prevention interventions for heterosexually active men in the United States gender-specific? *American Journal of Public Health*, 99(6), 981-984.

Epstein, H. (2008). *The invisible cure. Why we are losing the fight against AIDS in Africa*. Picador: New York.

Epstein, H. (2010). The mathematics of concurrent partnerships and HIV: A commentary on Lurie and Rosenthal, 2009. *AIDS & Behavior*, 14(1), 29-30.

Exner, T.M., Gardos, P.S., Seal, D.W. & Ehrhardt, A.A. (1999). HIV sexual risk reduction interventions with heterosexual men: The forgotten group. *AIDS & Behavior*, 3, 347-358.

Fisher, J.C., Bang, H. & Kapiga, S.H. (2007). The association between HIV infection and alcohol use: A systematic review and meta-analysis of African studies. *Sexually Transmitted Diseases*, 34, 856-863.

Garcia-Moreno, C., Jansen, H.A.F.M., Ellsberg, M., Heise, L. & Watts, C.H. (2006). Prevalence of intimate partner violence: findings from the WHO multi-country study on women's health and domestic violence. *Lancet*, 368, 1260-1269.

Gile, K.J. & Handcock, M.S. (2010). Respondent-driven sampling: an assessment of current methodology. *Sociological Methodology*. Accessed 8th August 2010 from <http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9531.2010.01223.x/pdf>

Goel, S. & Salganik, M.J. (2010). Assessing respondent-driven sampling. *Proceedings of the National Academy of Sciences of the United States of America*, 107(15), 6743-6747.

Gregson, S., Garnett, G.P., Nyamukapa, C.A., Hallett, T.B., Lewis, J.J.C., Mason, P.R. et al., (2006). HIV decline associated with behaviour change in Eastern Zimbabwe. *Science*, 311, 664-666.

Gregson, S., Zhuwau, T., Ndlovu, J. & Nyamukapa, C.A. (2002). Methods to reduce social desirability bias in sex surveys in low-development settings. *Sexually Transmitted Infections*, 29, 568-575.

Green, E.C., Mah, T.L., Ruark, A. & Hearst, N. (2009). A framework of sexual partnerships: risks and implications for HIV prevention in Africa. *Studies in Family Planning*, 40(1), 63-70.

Halperin, D. & Epstein, H. (2004). Concurrent sexual partnerships help to explain Africa's high HIV prevalence: implications for prevention. *The Lancet*, 364 (9429), 4-6.

Halperin, D. & Epstein, H. (2007). Why is HIV prevalence so severe in southern Africa? The role of multiple concurrent partnerships and lack of male circumcision: Implications for AIDS prevention. *The Southern African Journal of HIV Medicine*, March, 19-25.

Hearst, N. & Chen S. (2004). Condom promotion for AIDS prevention in the developing world? Is it working? *Studies in Family Planning*, 35(1). 39-47.

Heckathorn, D. (1997). Respondent driven sampling: a new approach to the study of hidden populations. *Social Problems*, 44,174-99.

Heckathorn, D. (2002). Respondent driven sampling II: deriving valid population estimates from Chain-Referral samples of hidden populations. *Social Problems*, 49,11-34.

Heckathorn, D.D. (2007). Extensions of respondent-driven sampling: analyzing continuous variables and controlling for differential recruitment. *Sociological Methodology*, 37,151-207.

Hladik, W. (2009). *IT use in a respondent driven sampling survey, Kampala, Uganda*. Presentation at the 2nd global HIV/AIDS surveillance meeting on new strategies in HIV surveillance in resource-constrained settings: a global HIV surveillance forum in Bangkok, Thailand, March 2-5, 2009.

Hoffman, S., O'Sullivan, L.F., Harrison, A., Dolezal, C. and Monroe-Wise, A. (2006). HIV risk behaviors and the context of sexual coercion in young adults' sexual interactions: Results from a diary study in rural South Africa. *Sexually Transmitted Diseases*, 33, 52-58.

Izazola-Licea, J.A., Wiegelmann, J. Arán, C. Guthrie, Y., De Lay P. & Avila-Figueroa, C. (2009). Financing the response to HIV in low-income and middle-income countries. *Journal of Acquired Immune Deficiency Syndromes*, 52, S119-S126.

Jewkes, R. (2002). Intimate partner violence: causes and prevention. *The Lancet*, 359, 1423-1429.

Jewkes, R., Dunkle, K., Nduna, M., Levin, J., Jama, N., Khuzwayo, N. et al. (2006a). Factors associated with HIV sero-status in young rural South African women: connections between intimate partner violence and HIV. *International Journal of Epidemiology*, 35, 1461-1468.

Jewkes, R., Dunkle, K., Koss, M.P., Levin, J.B., Nduna, M., Jama, N. et al. (2006b). Rape perpetration by young, rural South African men: Prevalence, patterns and risk factors. *Social Science and Medicine*, 63, 2949-2961.

Jewkes, R., Dunkle, K., Nduna, M. & Shai, N. (2010). Intimate partner violence, relationship power inequity, and incidence of HIV infection in young women in South Africa: a cohort study. *The Lancet*, 376, 41-48.

Jewkes, R. & Morrell, R., (2010). Gender and sexuality: emerging perspectives from the heterosexual epidemic in South Africa and implications for HIV risk and prevention. *Journal of the International AIDS Society*, 13(6). doi:10.1186/1758-2652-13-6. Accessed on 13 July 2010 from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2828994/>

Johnston, L.G., Malekinejad, M., Kendall, C., Iuppa, I.M. & Rutherford, G.W. (2008). Implementation challenges to using respondent-driven sampling methodology for HIV biological and behavioral surveillance: Field experiences in international settings. *AIDS & Behavior*, 12, S131-S141.

Johnston, L.G., Whitehead, S, Simic-Lawson, M. & Kendall, C. (2010). Formative research to optimize respondent-driven sampling surveys among hard-to-reach populations in HIV behavioral and biological surveillance: lessons learned from four case studies. *AIDS Care*. Accessed on 3rd August 2010 from <http://dx.doi.org/10.1080/09540120903373557>

Kalichman, S.C., Simbayi, L.C., Kaufman. M., Cain, D. & Jooste, S. (2007). Alcohol use and sexual risks for HIV/AIDS in sub-Saharan Africa: A systematic review of empirical findings. *Prevention Science*, 8, 141-151.

Kelly, R.J., Gray, R.H., Sewankambo, N.K., Serwadda, D., Wabwire-Mangen, F., Lutalo, T. et al. (2003). Age differences in sexual partners and risk of HIV-1 infection in rural Uganda. *Journal of Acquired Immune Deficiency Syndromes*, 32, 446-451.

Kendall, C., Kerr, L.R.F.S., Gondim, R.C., Werneck, G.L., Macena, R.H.M., Pontes, M.K. et al. (2008). An empirical comparison of respondent-driven sampling, time location sampling, and snowball sampling for behavioral surveillance in men who have sex with men, Fortaleza, Brazil. *AIDS & Behavior*, 12, S97-S104.

Kincaid, D.L., Parker, W., Schierhout, G., Connolly, C. & Pham, V.H.T. (2008). AIDS communication programmes, HIV prevention and living with HIV and AIDS in South Africa, 2006. Pretoria: JHHESA. Accessed on 13 July 2010 from <http://jhhesa.org/PDF/National%20Comm%20Report.pdf>

Kleinschmidt, I., Pettifor, A., Morris, N., MacPhail, C., Rees, H. (2007). Geographic distribution of Human Immunodeficiency Virus in South Africa. *American Journal of Tropical Medicine and Hygiene*. 77 (6), 1163-1169.

Langhaug, L.F., Sherr, L. & Cowan, F.M. (2010). How to improve the validity of sexual behaviour reporting: systematic review of questionnaire delivery modes in developing countries. *Tropical Medicine and International Health*, 15(3), 162-181.

Lansky, A. (2007). National behavioural surveillance systems for heterosexuals at risk for HIV infection. Conference proceedings from the Second Global HIV/AIDS Surveillance Meeting, Bangkok 2-5 March 2009. Accessed on 23 July 2010 from <http://www.hivsurveillance2009.org.index.html>.

Leclerc-Madlala, S. (2003). Transactional Sex and the Pursuit of Modernity. *Social Dynamics* 29:2, 213-233.

Leclerc-Madlala, S. (2008), Age-disparate and intergenerational sex in southern Africa: dynamics of hypervulnerability. *AIDS*, 22(Suppl. 4), S17-S25.

Leclerc-Madlala, S. (2009). Cultural scripts for multiple and concurrent partnerships in southern Africa: why HIV prevention needs anthropology. *Sexual Health*, 6, 103-110

Lipovsek, V., Longfield, K. & Buszin, J. (2010). Can follow-up study questions about correct and consistent condom use reduce respondent over-reporting among groups at high risk? An analysis of datasets from six countries. *Reproductive Health*, 7(9). Accessed on 5th August 2010 from <http://www.reproductive-health-journal.com/content/7/1/9>

Lu, X., Bentsson, L., Britton, T., Camitz, M. Jun Kim, B., Thorson, A. et al. (2010). The sensitivity of respondent-driven sampling method. Accessed on 6th August 2010 from http://arxiv.org/PS_cache/arxiv/pdf/1002/1002.2426v3.pdf

Luke, N. (2003). Age and economic asymmetries in the sexual relationships of adolescent girls in sub-Saharan Africa. *Studies in Family Planning*, 34(2), 67-86.

Luke, N. (2005). Confronting the “sugar daddy” stereotype: age and economic asymmetries and risky sexual behavior in urban Kenya. *International Family Planning Perspectives*, 31, 6-14.

Lurie, M.N. & Rosenthal, S. (2010). Concurrent partnerships as a driver of the HIV epidemic in sub-Saharan Africa? The evidence is limited. *AIDS & Behavior*, 14(1), 17-24.

Ma, X., Zhang, Q., He, X., Sun, W., Yue, H., Chen, S. et al. (2007). Results of 3 consecutive respondent-driven sampling surveys in Beijing, 2004 through 2006. *Journal of Acquired Immune Deficiency Syndromes*, 45, 581-587.

Magnani, R., Sabin, K., Saidel, T. & Heckathorn, D. (2005). Review of sampling hard-to-reach and hidden populations for HIV surveillance. *AIDS*, 19 (suppl. 2), S67-S72.

Magnus, M., Kuo, I., Shelley, K., Rawls, A., Peterson, J., Montanez, L. et al., (2009). Risk factors driving the emergence of a generalized heterosexual HIV epidemic in Washington, District of Columbia networks at risk. *AIDS*, 23(10), 1277-1284.

Mah, T. (2008). *Concurrent sexual partnerships and HIV transmission in Khayelitsha, South Africa*. for Social Science Research, University of Cape Town Working Paper No. 225. Retrieved on 8th July 2010 from <http://www.cssr.uct.ac.za/sites/cssr.uct.ac.za/files/pubs/WP225.pdf>.

Mah, T. & Maughan-Brown, B. (2009). *Social and cultural contexts of concurrency in Khayelitsha*. Centre for Social Science Research, University of Cape Town Working Paper No. 251. Retrieved on 8th July 2010 from <http://www.cssr.uct.ac.za/sites/cssr.uct.ac.za/files/pubs/WP251.pdf>

Mah, T.L. & Halperin, D.T. (2010a). Concurrent sexual partnerships and the HIV epidemics in Africa: Evidence to move forward. *AIDS & Behavior*, 14, 11-16.

Mah, T. & Halperin, D.T. (2010b). The evidence for the role of concurrent partnerships in Africa's HIV epidemics: A response to Lurie and Rosenthal. *AIDS & Behavior*, 14(1), 25-28.

Malekinejad, M., Johnston, L.G., Kendall, C., Kerr, L.R.F.S., Rifkin, M.R. & Rutherford, G.W. (2008). Using respondent-driven sampling methodology for HIV biological and behavioral surveillance in international settings: A systematic review. *AIDS & Behavior*, 12, S105-S130.

McCoy, S.I., Kangwende, R.A. & Padian, N.S. (2010). Behavior change interventions to prevent HIV infection among women living in low and middle income countries: A systematic review. *AIDS & Behavior*, 14, 469-482.

Médecins Sans Frontières (2008). *Comprehensive TB/HIV services at primary health care level. Khayelitsha annual activity report, 2007-2008*. Accessed on 2nd June, 2010 from http://www.msf.or.jp/info/pressreport/pdf/2009_hiv01.pdf

Médecins Sans Frontières (2010). *No time to quit: HIV/AIDS treatment gap widening in Africa*. Brussels: Author.

Mngadi, S. et al. (2009). *Swaziland: HIV prevention response and modes of transmission analysis*. Mbabane: National Emergency Response Council on HIV/AIDS.

Morojele, N.K., Kachieng'a, M.A., Mokoko, E., Nkoko, M.A., Parry, C.D.H., Nkowane, A.M., et al. (2006). Alcohol use and sexual behaviour among risky drinkers and bar and shebeen patrons in Gauteng province, South Africa. *Social Science & Medicine*, 62, 217-227.

Morris, M. & Kretzschmar, M. (1997). Concurrent partnerships and the spread of HIV. *AIDS*, 11(5), 641-648.

Morris, M. (2010). Barking up the wrong evidence tree. Commentary on Lurie & Rosenthal, "Concurrent partnerships as a driver of the HIV epidemic in sub-Saharan Africa? The evidence is limited". *AIDS & Behavior*, 14(1), 31-33.

Napper, L.E., Fisher, D.G., Reynolds, G.L. & Johnson, M.E. (2010). HIV risk behavior self-report reliability at different recall periods. *AIDS & Behavior*, 14, 152-161.

National Department of Health (2008). *2008 National antenatal sentinel HIV & syphilis prevalence survey*. Department of Health: Pretoria.

Neaigus, A., Jenness, S.M., Hagan, H., Murrill, C.S. & Wendel, T. (2009). *Individual and partner characteristics associated with sex partner concurrency among high-risk heterosexuals*. Presented at the 2009 National HIV Prevention Conference, Atlanta, GA, August 24, 2009.

Nelson, S.J., Manhart, L.E., Gorbach, P.M., Martin, D.H., Stoner, B.P., Aral, S.O. et al., (2007). Measuring sex partner concurrency: it's what's missing that counts. *Sexually Transmitted Diseases*, 34 (10), 801-807).

Parker, W., Makhubele, B., Ntlabati & P. Connolly, C. (2007). *Concurrent sexual partnerships amongst young adults in South Africa, Challenges for HIV prevention communication* [e-report].

Grahamstown (South Africa): CADRE. Accessed on 30 June 2010 from <http://www.cadre.org.za/node/140>.

Parry, C., Rehm, J., Poznyak, V. & Room, R. (2009). Alcohol and infectious diseases: an overlooked causal linkage? *Addiction*, 104, 331-332.

President's Emergency Plan For AIDS Relief (PEPFAR) (2009). *Surveillance and surveys*. Washington DC; Author.

Phillips, A.E., Gomez, G.B., Boily, M. & Garnett, G.P. (2010). A systematic review and meta-analysis of quantitative interviewing tools to investigate self-reported HIV and STI associated behaviours in low- and middle-income countries. *International Journal of Epidemiology*, 1-15. doi:10.1093/ije/dyq114

Pilcher, C.D., Tien, H.S., Eron, J.J., Vernazza, P.L., Leu, S-Y, Stewart, P.W., et al. (2004). Brief but efficient: acute HIV infection and the sexual transmission of HIV. *Journal of Infectious Diseases*, 189(10), 1785-1792.

Potts, M., Halperin, D.T., Kirby, D., Swindler, A., Marseille, E., Klausner, J.D. et al., (2008). Reassessing HIV prevention, *Science*, 320, 749-750.

Rehle, T., Lazzari, S., Dallabetta, G. & Asamoah-Odei, E. (2004). Second-generation HIV surveillance: better data for decision-making. *Bulletin of the World Health Organization*, 82, 121-127.

Rehm, J., Rehn, N., Room, R., Monteiro, M., Gmel, G., Jernigan, J. et al. (2003). The global distribution of average volume of alcohol consumption and pattern of drinking. *European Addiction Research*, 9, 147-156.

Reichmann, W.M., Losina, E., Seage III, G.R., Arbelaez, C., Safren, S.A., Katz, J.N. et al. (2010). Does modality of survey administration impact data quality: Audio

computer assisted self interview (ACAS) versus self-administered pen and paper?
PlosONE, 5(1), e8728.

Richards, J.E., Risser, J.M., Padgett, P.M., Rehman, H.U., Wolverton, M.L. & Arafat, R.R. (2008). Condom use among high-risk heterosexual women with concurrent sexual partnerships, Houston, Texas, USA. *International Journal of STD & AIDS*, 19, 768-771.

Risser, J. & Padgett P. (2007). *Using respondent driven sampling in high risk areas to recruit heterosexuals at high risk of HIV: Demographic results from the Houston site of the National HIV Behavioral Surveillance project*. 135th Annual Meeting and Exposition of the American Public Health Association (APHA). Washington, DC. 2007. Accessed on 2nd July 2010 from http://apha.confex.com/apha/135am/techprogram/paper_167096.htm.

Risser, J., Padgett, P., Richards, J., Rehman, H. & Wolverton, M. (2007). *Success of respondent driven sampling in high risk areas to identify heterosexuals at high risk of HIV. Demographic results from the Houston site of the National HIV Behavioral Surveillance Project*. Conference proceedings from the Second Global HIV/AIDS Surveillance Meeting, Bangkok 2-5 March 2009. Accessed on 23 July 2010 from <http://www.hivsurveillance2009.org.index.html>.

Rose, E., DiClemente, R.J., Wingood, G.M., McDermott Sales, J., Latham, T.P., Crosby, R.A. et al., (2009). The validity of teens' and young adults' self-reported condom use. *Archives of Pediatric Adolescent Medicine*, 163(1), 61-64.

Salganik, M.J. & Heckathorn, D.D. (2004). Sampling and estimation in hidden populations using respondent-driven sampling. *Sociological Methodology*, 34, 193-239.

Sandøy, I.F., Dzekedzeke, K. & Fylkesnes, K. (2010). Prevalence and correlates of concurrent sexual partnerships in Zambia. *AIDS & Behavior*, 14(1), 59-71. doi:10.1007/s10461-008-9472-3

Scott, G. (2008). "They got their program, and I got mine": A cautionary tale concerning the ethical implications of using respondent-driven sampling to study injection drug users. *International Journal of Drug Policy*, 19, 42-51.

Semaan, S., Santibanez, S., Garfein, R.S., Heckathorn, D.D. & Des Jarlais, D.C. (2009). Ethical and regulatory considerations in HIV prevention studies employing respondent-driven sampling. *International Journal of Drug Policy*, 20, 14-27.

Shaikh, N. Abdullah, F., Lombard, C.J., Smit, L., Bradshaw, D. & Makubalo, L. (2006). Masking through averages – intraprovincial heterogeneity in HIV prevalence within the Western Cape. *South African Medical Journal*, 96, 538-543).

Shelton, J.D. (2006). Confessions of a condom lover. *Lancet*, 368, 1947-1948.

Shelton, J.D. (2007). Ten myths and one truth about generalised HIV epidemics. *Lancet*, 370, 1809-1811.

Shelton, J.D. (2009). Why multiple sexual partners? *Lancet*, 374, 367-368.

Shisana, O. Rehle, T., Simbayi, L.C., Parker, W., Zuma, K., Bhana, A., Connolly, C., Jooste, S., Pillay, V. et al. (2005). *South African national HIV prevalence, HIV incidence, behaviour and communication survey*. Cape Town; Human Sciences Research Council Press.

Shisana, O., Rehle, T., Simbayi, L.C., Zuma, K., Jooste, S., Pillay-Van Wyk, V. et al. (2009). *South African national HIV prevalence, incidence, behaviour and communication survey, 2008: a turning tide among teenagers?* Cape Town (South Africa): HSRC Press.

Shuper, P.A., Joharchi, N., Irving, H. & Rehm, J. (2009). Alcohol as a correlate of unprotected sexual behavior among people living with HIV/AIDS: Review and meta-analysis. *AIDS & Behavior*. doi 10.1007/210461-009-9589-z.

Simbayi, L.C., Kalichman, S.C., Jooste, S., Mathiti, V., Cain, D. & Cherry, C. (2006). HIV/AIDS risks among South African men who report sexually assaulting men. *American Journal of Health Behavior*, 30 (2), 158-166.

South African Government (2008). *The HIV & Aids and STI National Strategic Plan for South Africa 2007-2011*. Pretoria, South Africa: Author.

South African Government (2010). *Country progress report on the declaration of commitment on HIV/AIDS*. Pretoria: Author. Accessed on 5th July 2010 from http://data.unaids.org/pub/Report/2010/southafrica_2010_country_progress_report_en.pdf

Soul City (2008). *Onelove: Multiple and concurrent sexual partnerships in southern Africa, a ten country research report*. Johannesburg: Author.

Statistics South Africa (2001). *City of Cape Town – Census 2001 – Khayelitsha*. Accessed on 25th May 2006 from <http://www.capetown.gov.za/censusInfo/Census2001-new/Suburbs/Khayelitsha.htm>

Stoneburner, R.L. & Low-Beer, D. (2004). Population-level HIV declines and behavioural risk avoidance in Uganda. *Science*, 304, 714-718.

Turner, A.N., De Kock, A.E., Meehan-Ritter, A., Blanchard, K., Sebola, M.H., Hoosen, A.A. et al. (2009). Many vaginal microbicide trial participants acknowledged they had misreported sensitive sexual behavior in face-to-face interviews. *Journal of Clinical Epidemiology*, 62, 759-765.

UNAIDS (2000). *Guidelines for second generation HIV surveillance*. Geneva, Switzerland: Author.

UNAIDS (2006). *Report on the global AIDS epidemic*. Geneva, Switzerland: Author.

UNAIDS (2008). *Multiple concurrent partnerships campaigns and communications towards a coordinated regional response*. Geneva, Switzerland: Author.

UNAIDS (2008a). *UNAIDS annual report. Knowing your epidemic*. Geneva, Switzerland: Author.

UNAIDS (2009a). *AIDS epidemic update*. Geneva, Switzerland: Author.

UNAIDS (2009b). *Impact of the global financial and economic crisis on the AIDS response*. Geneva, Switzerland: Author.

UNAIDS (2009c). *Monitoring the Declaration of Commitment on HIV/AIDS: Guidelines on construction of core indicators: 2010 reporting*. Geneva, Switzerland: Author.

UNAIDS (2009d). *Addressing multiple and concurrent partnerships in southern Africa: developing guidance for bold action*. Geneva, Switzerland: Author.

UNAIDS (2009e). *Joint action for results: outcome framework 2009-2011*. Geneva, Switzerland: Author. Accessed on 12 July 2010 from http://data.unaids.org/pub/BaseDocument/2010/jc1713_joint_action_en.pdf

USAID (2009). *Request for proposals (RFP) no: 674-09-71 HIV/AIDS sexual prevention program*. Pretoria (South Africa): USAID Southern Africa.

Weir, S.S., Morroni, C., Coetzee, N., Spencer, J. & Boerma, J.T. (2002). A pilot study of a rapid assessment method to identify places for AIDS prevention in Cape Town, South Africa. *Sexually Transmitted Infections*, 78 (Suppl. 1), 106-113.

Weir, S., Pailman, C., Mahlalela, X., Coetzee, N., Meidant, F. & Borma, J.T. (2003). From people to places: focusing AIDS prevention efforts where it matters most. *AIDS*, 17, 895-903.

Weir, S.S., Tate, J.E., Zhusupov, B. & Boerma, J.T. (2004). Where the action is: monitoring local trends in sexual behaviour. *Sexually Transmitted Infections*, 80(Suppl. II), ii63-ii68.

Wood, K., & Jewkes, R. (2001). "Dangerous" love: reflections on violence among Xhosa township youth. In R. Morrell (ed.), *Changing men in South Africa* (pp. 317-336). Pietermaritzburg, South Africa: University of Natal Press.

World Health Organization (2008). *HIV/AIDS epidemiological surveillance report for the WHO African region: 2007 update*. Accessed on 17th June 2010 from www.afro.who.int/index.php?option=com_docman&task=doc_download&gid=1913

